PCT/GB99/01551

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 28 January 2000 (28.01.00)	
International application No. PCT/GB99/01551	**Applicant's or agent's file reference** JL2114
International filing date (day/month/year) 14 May 1999 (14.05.99)	**Priority date** (day/month/year) 15 May 1998 (15.05.98)
Applicant SCULLION, Simon, Daniel et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

14 December 1999 (14.12.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer S. Mafla
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

3076507

Copy for the Elected Office (EO/US)

PCT/GB99/01551

TENT COOPERATION TREA

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

BARKER BRETTELL
138 Hagley Road
Edgbaston
Birmingham B16 9PW
ROYAUME-UNI

Date of mailing (day/month/year)
26 October 2000 (26.10.00)

Applicant's or agent's file reference
JL2114

IMPORTANT NOTIFICATION

International application No.
PCT/GB99/01551

International filing date (day/month/year)
14 May 1999 (14.05.99)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
BASS PUBLIC LIMITED COMPANY
Centrum 100
1 First Avenue
Burton-on-Trent
Staffordshire DE14 2WB
United Kingdom

State of Nationality: GB
State of Residence: GB
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [X] the nationality [X] the residence

Name and Address
BRANDBREW SA
Rue Goethe
11, BP 1107
Luxembourg

State of Nationality: LU
State of Residence: LU
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:
Power of attorney authorizing BARKER BRETTELL to represent the applicant BRANDBREW SA is required.

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Mougamadou ABIDINE
Telephone No.: (41-22) 338.83.38

003615717

EXPRESS LAB #EF144540673 US

WO 99/60092
PCT/GB99/01551

PCT

TENT COOPERATION TREA

DATE OF MAILING

- 3 DEC 1999

From the INTERNATIONAL BUREAU

To:
BARKER BRETTELL
138 Hagley Road
Edgbaston
Birmingham B16 9PW
ROYAUME-UNI

JD
records

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 25 November 1999 (25.11.99)	
Applicant's or agent's file reference JL2114	IMPORTANT NOTICE

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/GB99/01551	14 May 1999 (14.05.99)	15 May 1998 (15.05.98)

Applicant
BASS PUBLIC LIMITED COMPANY et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,EP,JP,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   CA,GB,NO,SG,ZA

   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   25 November 1999 (25.11.99) under No. WO 99/60092

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone N . (41-22) 338.83.38

Form PCT/IB/308 (July 1996)

2960448

Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

Date of mailing (day/month/year)	IMPORTANT NOTICE
25 November 1999 (25.11.99)	
Applicant's or agent's file reference	**International application No.**
JL2114	PCT/GB99/01551

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.

TENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
JL2114		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 99/ 01551	14/05/1999	15/05/1998

Applicant

BASS PUBLIC LIMITED COMPANY et al.

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with th abstract is Figure No. _____

   [ ] as suggested by th applicant.

   [ ] because th applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/01551

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C12H1/18 B67D1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C12H B67D C12G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 826 829 A (MARULICH A) 30 July 1974 (1974-07-30) column 2, line 16 - line 32 column 4, line 1 - line 8 column 4, line 57 - line 62	2,33
X	DATABASE WPI Section Ch, Derwent Publications Ltd., London, GB; Class D13, AN 1971-19784S XP002119502 & JP 46 010033 B (MORINAGA MILK INDS CO LTD) abstract	2,33

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 October 1999	29/10/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Charles, D

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/01551

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 683 223 A (BASS PLC) 22 November 1995 (1995-11-22) column 1, line 1 - line 3 column 1, line 19 - line 24 column 2, line 9 - line 11 column 2, line 21 - line 25	1,3-5, 25-28
A	EP 0 268 097 A (HEUBLEIN INC) 25 May 1988 (1988-05-25) page 2, line 4 - line 6; claims 1,15 page 3, line 3 - line 17 page 4, line 27 - line 32 page 5, line 57 -page 6, line 1	1,2,33
A	US 5 709 095 A (JOHNSON GREG A) 20 January 1998 (1998-01-20) the whole document	44,45, 59-76, 107
A	GB 1 208 334 A (VENDO COMPANY) 14 October 1970 (1970-10-14) the whole document	44,45, 59-76, 107

1

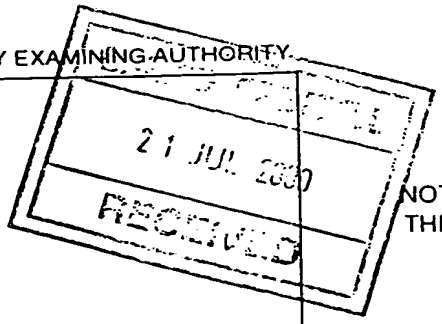
INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 99/01551

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3826829 A	30-07-1974	AU 451608 B	15-08-1974
		AU 3514271 A	03-05-1973
		CA 950745 A	09-07-1974
JP 46010033 B		NONE	
EP 0683223 A	22-11-1995	GB 2289477 A,B	22-11-1995
		EP 0683224 A	22-11-1995
		GB 2289425 A,B	22-11-1995
EP 0268097 A	25-05-1988	US 4790999 A	13-12-1988
		AU 581374 B	16-02-1989
		AU 8045487 A	05-05-1988
		JP 63160572 A	04-07-1988
US 5709095 A	20-01-1998	JP 9098723 A	15-04-1997
GB 1208334 A	14-10-1970	US 3468137 A	23-09-1969

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY



To:

Barker Brettell
138 Hagley Road
Edgbaston
Birmingham B16 9PW
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

	Date of mailing *(day/month/year)* 19.07.2000
Applicant's or agent's file reference JL2114	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/01551	14/05/1999	15/05/1998

Applicant
BASS PUBLIC LIMITED COMPANY et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

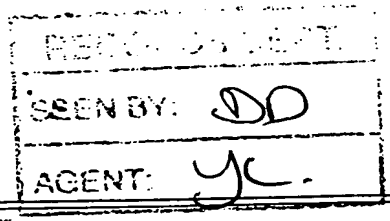
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of th report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.



Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Bleeker. M Tel.+49 89 2399-8141

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
JL2114		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/01551	14/05/1999	15/05/1998
International Patent Classification (IPC) or national classification and IPC		
C12H1/18		
Applicant		
BASS PUBLIC LIMITED COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 11 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 50 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
14/12/1999	19.07.2000
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Diez Schlereth, D Telephone No. +49 89 2399 7488

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/01551

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-33	as received on	07/06/2000	with letter of	02/06/2000

Claims, No.:

1-43,49-56, 65-110	as received on	07/06/2000	with letter of	02/06/2000
44*,45-48,57-64	as received on	04/07/2000	with letter of	30/06/2000

* part of claim 44 as filed with letter of 30.06.00, and partially as filed with letter of 02.06.00

Drawings, sheets:

1/8-8/8	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

see separate sheet

4. Additional observations, if necessary:

see separate sheet

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application.

☒ claims Nos. 104.106-110.

because:

☒ the said international application, or the said claims Nos. 104 relate to the following subject matter which does not require an international preliminary examination (*specify*):

see separate sheet

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 106-110 are so unclear that no meaningful opinion could be formed (*specify*):

see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

   ☐ restricted the claims.

   ☐ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1. 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

   see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-60,77-103, 105
	No:	Claims	61,75-76
Inventive step (IS)	Yes:	Claims	1-60,77-103,105
	No:	Claims	61-76
Industrial applicability (IA)	Yes:	Claims	1-103,105
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

item I.

1.) The following amendments do not meet the requirements of Art. 34 (2) (b) PCT, since they introduce subject-matter which was not disclosed in the application as originally filed:

description, page 19, line 10: the amendment of the range "4-5% abv." by the absolute value "4.5% abv." cannot be considered the correction of an obvious error, since this value was not mentioned anywhere in the application as originally filed.

claim 104: the range "3.5% to 5.5% abv." was not disclosed anywhere in the application as originally filed.

2.) claim 44 (partially) as filed with letter of 02.06.00 and (partially) as filed with letter of 30.06.00.

item III.

No meaningful opinion (Art. 34 (4) (a) (ii) and (b) PCT, PCT Guidelines IV-3.1) can be given for the subject-matter of claims 106-110 for the following reason: the claims are not supported by the description in their full breadth (Art. 6, Rule 6.2 (a) PCT, PCT Guidelines III-6.1) due to the vague wording "substantially as hereinbefore described with reference to" and the lack of distinguishing technical features in the wording of said claims (PCT Guidelines III-2.1).

As regards the subject-matter of claim 104, see item I. above.

item IV.

The separate inventions are:

claims 1, 3-5, 8, 82, 99 and 101 (and 6-7, 9-32, 35-43, 60, 77-81, 83-98, 100, 102-103 and 105 as dependent thereon): a beverage which sustains a head of foam in an open-topped vessel, an open-topped vessel of said beverage and methods of sustaining cooling ice, of sustaining a head and of serving draught.

independent claims 2, 33-34 and 44-45 (and 35-43 and 46-60 as dependent thereon): an alcoholic beverage beverage, an alcoholic beverage to be available on draught and methods of serving said beverage, keeping cool an open-topped vessel of said beverage and providing a visual display or effect in said beverage.

independent claim 61 (and 62-76 as dependent thereon): apparatus to supply a draught beverage.

They are not so linked as to form a single general inventive concept (Rule 13.1 PCT) for the following reasons:

(i) it would appear that a method for keeping cool a beverage in an open topped vessel based on the formation of ice from its water contents is known from the prior art (see item V. below). Therefore, the the new and inventive concept behind independent claims 1, 3-5, 8, 82, 99 and 101 is that **the beverage in which ice is to be formed from its water content sustains a head of foam**. However, in the light of the known prior art, the novel and inventive concept behind independent claims 2, 33-34 and 44-45, appears to be that **the beverage in which ice is to be formed from its water content is an alcoholic beverage.** This gives rise to an objection of lack of unity "a posteriori" (Rule 13.2 PCT, see PCT Guidelines III-7.1).

(ii) The subject-matter of independent claim 61 relates to an **apparatus to supply a draught beverage**. The claim does not specify if said apparatus is specially adapted to supply (dispense) a draught beverage in which ice is to be formed from its water content. This gives rise to an objection of lack of unity "a priori" (Rule 13.2 PCT, see PCT Guidelines III-7.1).

item V.

1.) Reference is made to the following documents:

D1: JP-B-46 010 033 (Derwent Abstracts 1971-19784S) .
D2: US-A-3,826,829
D3: EP-A-0 268 097
D4: US-A-5,709,095

independent claims 1, 3-5, 8, 82, 99, 101

2.) The subject-matter of independent claims 1, 3-5, 8, 82, 99 and 101 is considered novel and inventive within the sense of Art. 33 (2) and (3) PCT for the following reasons (see, however, item VIII. below):

D1 which is considered to be the closest state of the art as regards claim 1, discloses a carbonate drink and a method for its production, in that fine ice is formed from its water contents at the time of breaking the super cooled state by stimulation of the dissolved CO_2 on uncovering the container (Abstract). The subject-matter of independent claim 1 differs therefrom in that **the beverage has a head of foam over ice.**

In the light of the closest state of the art (D1), the technical problem to be solved by the present invention as regards claim 1 was to find a novel application of a known method of cooling beverages.

The solution proposed in claim 1 (and claims 6-7, 9-32, 35-43, 60, 77-81, 103 and 105 as dependent thereon) can be considered inventive for the following reasons:

The stimulation of gas bubbling in the beverage leads to formation of ice from its water content, which consequently produces a cooling effect without diluting the beverage. It was surprisingly found that gas evolution does not disrupt the head of foam in the beverage and that said head of foam acts as a heat insulation means which results in the fact that the beverage may be kept cold for an extended period of time. In addition, formation of ice appears to reduce the rate of release of dissolved gas from the beverage which results in an improvement of the taste, flavour or bite. Furthermore, formation of ice results in an interesting visual display in the beverage. The method of the invention can be successfully used even for cooling beverages with a very fragile head of foam, such as draught cider.

Although a method of cooling a carbonated beverage based on the formation of ice from its water content is known from D1, this document does not give any hint about the possibility of using this method with a beverage which sustains a head of foam without the risk of disrupting said head of foam.

Document D2, discloses a method to produce a carbonated slush beverage containing fine-grained ice crystals (col. 1, l. 10-20, 28-65; col. 2, l. 1-10, 55-65). This document discloses the use of a stabilizer (pectin in combination with other gums) of the viscosity of the liquid formulation with the purpose to avoid formation of a few large agglomerates of ice which form a separate phase on the top of the liquid phase.

The skilled person confronted with the above mentioned technical problem and equipped with the teaching of D1-D2 would have expected that the use of the method of D1 with beverages which sustain a head of foam would unavoidably result in a solid-liquid phase separation which consequently would destroy the head of foam and would have not arrived at the present invention as claimed in claim 1.

The subject-matter of independent claims 3-5, 8, 82, 99 and 101 (and 6-7, 9-32, 35-43, 60, 77-81, 83-98, 100, 102-103 and 105 as dependent thereon) is to be considered novel and inventive within the sense of Art. 33 (2) and (3) PCT for analogous reasons as discussed above.

independent claims 2, 33-34 and 44-45

3.) The subject-matter of independent claims 2, 33-34 and 44-45 is considered novel and inventive within the sense of Art. 33 (2) and (3) PCT for the following reasons (see, however, item VIII. below):

The subject-matter of independent claim 2 differs from the closest state of the art (D1, see item 2. above) in that **the beverage is an alcoholic beverage**.

In the light of the closest state of the art (D1), the technical problem to be solved by the present invention as regards claim 2 was to find a novel application of a known method of cooling beverages.

The solution proposed in claim 2 (and claims 6-7 and 60 as dependent thereon) can be considered inventive for the following reasons:

The method of claim 2 allows to keep an alcoholic beverage in an open-topped vessel cool for a longer time and gives rise to interesting visual effects. Furthermore, since ice

is formed from the water content in the beverage, the beverage is not diluted by ice and the overall amount of alcohol remains the same. In fact, since water is being used to form ice, the alcoholic strength of the beverage increases until the ice melts.

D2 discloses liquid beverage formulations (e.g. carbonated soft drinks which contain a small amount of ethanol) which are to be consumed in the form of slush beverages (col. 1, l. 12-20, 29-37, 62-66; col. 2, l. 15-45, 60-65; col. 3, l. 2-61; col. 4, l. 1-8, 35-36).

D3 discloses a ready-to-consume, freezable alcoholic beverage, which is to be consumed as a slush-type frozen cocktail (p. 2, l. 3-5, 44-51; p. 3, l. 1-17, 33-34, 41-49).

The method of D1 is applied to non-alcoholic milk-based beverages. D2 and D3 disclose alcoholic beverages which are to be consumed as slush beverages or soft-ice.

Thus, the skilled person confronted with the above mentioned technical problem and equipped with the teaching of D1-D3 would not have been motivated to apply the method of D1 for keeping cool an alcoholic beverage as those disclosed in D2 and D3 and would not have arrived at a method according to claim 2.

The subject-matter of independent claims 33-34 and 44-45 (and 35-43 and 46-60 as dependent thereon) is to be considered novel and inventive within the sense of Art. 33 (2) and (3) PCT for analogous reasons as discussed above.

independent claim 61

4.) It would appear that independent claim 61 does not comprise any feature which distinguishes its subject-matter from a conventional dispenser of frozen beverages as that disclosed in D4 (see Abstract; col. 1, l. 58-68; col. 2, l. 1-10; claim 1). Therefore, the subject-matter of independent claim 61 (and 75-76 as dependent thereon) is not novel within the sense of Art. 33 (2) PCT, since it is anticipated by D4.

5.) Although D4 does not explicitly disclose the subject-matter of dependent claims 62-74, these claims do not seem to comprise any features which, in combination with the features of any claim to which they refer, meet the requirements of Art. 33 (3) PCT in

respect of inventive step, the reasons being as follows: claims 62-74 comprise only features which are related to slight constructional changes in the apparatus of claim 61 which come within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be foreseen.

item VII.

Contrary to the requirements of Rule 5.1 (a) (ii) PCT, the relevant background art disclosed in the documents D1-D4 is not mentioned in the description, nor are these documents identified therein.

item VIII.

1.) The present application does not meet the requirements of Art. 5 PCT. The whole application fails to provide a sufficient disclosure of the composition of the beverage which gives rise to the described technical effect. Under such circumstances, the skilled person does not have enough information to carry out the present invention without an undue experimental burden. Moreover, in this particular case it seems that this deficiency cannot be overcome without contravening Art. 34 (2) (b) PCT (PCT Guidelines II-4.1 and II-4.10).

2.) It would appear that the beverage of the present invention must comprise particular ingredients which give rise to the formation of ice concomitant with the evolution of gas bubbles that result in both a temperature decrease and the appearance of a visual display in the beverage. It also appears obvious that these effects cannot be obtained with every beverage which comprises a water content and a gas content dissolved therein. Thus, the composition of the beverage responsible for the above mentioned technical effect seems to be essential to the definition of the invention.

Since independent claims 1-5, 8, 33-34, 44-45, 82, 99 and 101 do not contain this feature they do not meet the requirement following from Art. 6 PCT taken in combination with Rule 6.3 (b) PCT that any independent claim must contain all the technical features essential to the definition of the invention (PCT Guidelines III-4.3).

3.) Claims 1-5, 12, 38-41, 44-45, 49, 51-52, 54-55, 95, 99 and 101 do not meet the

requirements of Art. 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter (the process of formation of ice in the beverage, a dispense outlet adapted to..., the shape, internal surface and walls of the vessel, the means of storing and handling the beverage) in terms of the result to be achieved which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result should have been included in the wording of the claims (PCT Guidelines III-4.7).

4.) The terms "water/gas content", "a mass of", "chilled", "about", "roughened", "substantially", "substantially an upper level" and "some transparency" used in claims 1-5, 8, 15-22, 26-28, 33-34, 36, 40, 44-46, 48, 76, 82-84, 87-91, 98-99 and 101 are vague and unclear and leave the reader in doubt as to the meaning of the technical features to which they refer, thereby rendering the definition of the subject-matter of said claims unclear (Art. 6 PCT, PCT Guidelines III-4.5).

5.) The is a verbal inconsistency between the wording of claim 47 "the vessel comprises glass" and the description "the vessel may be a glass" (see p. 2, l. 7-8) which renders the subject-matter of said claim unclear (Art. 6 PCT).

6.) Claim 55 broadly defines the feature "implement" in terms of its function (to encourage the formation of ice...). However, the description and drawings convey the impression that this function can only be carried out in a particular way, namely by introducing a kind of stick into the beverage (see claims 56-57), and no alternative means are envisaged. Hence, the claim is not supported by the description (Art. 6 PCT).

7.) The difference between a "colouring material" and a "dye" is not obvious for the skilled person and renders the subject-matter of claim 58 unclear (Art. 6 PCT).

8.) The subject-matter of claims 100 and 102 is not clearly defined (Art. 6 PCT). The claims attempt to define the subject-matter for which protection is sought (a head and ice in cidre) by the process of manufacture and not by technical features inherent to the product.

A BEVERAGE

This invention relates to a beverage, to methods of presenting or serving a beverage, to providing a visual display in a beverage, and to apparatus to supply draught beverage.

The beverage concerned comprises a water content and a dissolved gas content.

The beverage may be an alcoholic beverage or a non-alcoholic beverage. For example, the beverage may be a beer, a cider, a flavoured alcoholic beverage, for example an alcoholic lemonade or other alco-pop style of drink, or a so-called low alcoholic drink. The term "beer" embraces lager, ale, porter and stout and includes a beverage comprising hops flavouring, an alcohol content derived from malt and fermentation, a water content, and a dissolved gas content.

One object is to provide a cool beverage using ice therein in a way which a consumer may find more agreeable because dilution of the drink cannot occur.

Another object to provide a beverage which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

Another object is to provide a beverage in which a head thereon may be sustained.

Another object is to provide a beverage in which ice may develop therein as an interesting visual display.

According to a first aspect of the invention there is provided a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and in said vessel the beverage having a head of foam over ice, said ice being formed in the beverage from water of said water content.

The vessel may be any suitable vessel, for example a drinking vessel, for example a glass.

Preferably there is a layer of ice adjacent the head, in contact with the head. Preferably there is a projection of ice extending downwards, away from the head, and being provided in the region of the head. The projection of the ice may depend directly from the head, or from a layer of ice beneath the head.

The ice is preferably made of many small crystals of ice, rather than a single solid mass. The ice is preferably slushy in character, rather than being a solid mass. There may be more than one kind of ice formation in the beverage. There may be a fine, powdery ice. There may be a flaky ice, of the order of 1 or 2mm or 3mm or 4mm, or more, in their longest dimension of the flakes.

The beverage, which may be coloured as distinct from white or water clear, may have bands, or stripes, across it at different heights, the bands possibly being white layers where nucleation is taking place, and beverage-coloured layers interposed between the white layers where less nucleation is taking place. This effect may be achieved by using ultrasound on the vessel, for example a glass, of beverage. The white

bands and the interposed beverage-coloured bands may be of substantially the same thickness.

The white bands interspersed by beverage-coloured bands may exist for a matter of seconds, rather than minutes, and typically exist for 1 to 10 seconds, preferably about 3 to 6 seconds. The white bands/beverage-coloured bands interspersed may exist for substantially the same time as ultrasound is applied to the vessel of beverage.

Nucleation means may be provided to encourage the formation of the ice crystals and/or head in the beverage when it is in a vessel. The nucleation means is preferably the administration of ultrasound, preferably to the bottom portion of a vessel of beverage, but it could be other forms of nucleation inducement. For example the vessel and/or dispense tap/nozzle (or an object to be inserted into the vessel of beverage) may have a roughened surface/high surface area surface to encourage nucleation (such as a sintered surface, etched surface, or a surface of ground material, such as glass); or a rapid and suitably large pressure drop may be provided to induce nucleation; or mechanical agitation may be provided; or the beverage may be arranged to have turbulent flow to promote nucleation; or an amount of liquid, possibly highly supersaturated with gas, may be introduced or injected; or gas may be otherwise introduced, or injected, or the glass may be vibrated in some way (e.g. by being exposed to sound waves, or the vessel may be vibrated in some other way); or by introducing a chemical (e.g. tablet) or device which generates bubbles (for example a chemical pellet may effervesce or dissolve, releasing bubbles).

According to a second aspect of the invention there is provided a method of keeping an acholic beverage in an open-topped vessel cool, said

beverage comprising a water content and a dissolved gas content, and said method comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

According to a third aspect of the invention there is provided a method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on the beverage such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

According to a fourth aspect of the invention there is provided a method of sustaining a head on beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, said method comprising providing a head on the beverage and forming ice in the beverage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

According to a fifth aspect of the invention, there is provided an open-topped vessel of a beverage the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

Preferably the vessel has a transparent or translucent wall or at least has a window of transparent or translucent material.

Preferably the ice formation extends substantially the width of the mouth of the vessel, or completely across the width of the mouth. It may comprise substantially homogenous ice-crystals in a head-contacting region or layer. Alternatively, the ice crystals that contact the head may not be substantially homogeneous.

The ice formation may have a projection extending away from the head. The projection may comprise flakes of ice that are larger than the ice at the ice-head boundary.

The ice at the ice-head interface may have been formed before the ice flakes of the projection.

The beverage may have been subjected to ultrasound signals and may be draught beverage delivered into the vessel. Before the draft beverage is delivered into the vessel, and preferably immediately before, the beverage may be cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

According to a sixth aspect of the invention there is provided a method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beverage to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beverage into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas bubble nucleation means.

The ultrasound signals may be applied externally of said vessel, and/or the ultrasound signals may be applied internally of said vessel to the cooled beverage. In the latter case an ultra-sonic emitter provided as or incorporated into a probe may be disposed in the beverage in the vessel. If desired a dispense outlet or nozzle from which the beverage is delivered into the vessel may be adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals to beverage in the vessel. Such signals may be applied to the beverage as it passes through the dispense outlet.

Ultrasound signals can be applied to beverage not only after it has been delivered into the vessel, but also whilst it is being delivered.

The ultrasound signals may have a frequency in the range of 20kHz to 70kHz. For example, the ultrasound signals may have a frequency of substantially 30kHz.

A mass of aforesaid ice may develop downwards in the beverage below the head.

Preferably, the vessel is chilled before the beverage is delivered thereinto. The vessel may be chilled to a temperature of substantially 4°C, or the vessel may be chilled to a temperature less than 4°C. For example, the vessel may be chilled to a temperature of substantially 0°C.

Prior to the delivery, and preferably just prior to the delivery, a draught beverage may be cooled to a temperature in a range of between substantially -1°C and substantially -12°C and may issue at a temperature substantially in that range into the vessel. If desired, the beverage may be

cooled to a temperature between substantially -4°C and substantially -6°C. The greater the alcohol strength by volume (abv), the lower the temperature to which the alcoholic beverage may be cooled. We may aim to achieve a dispense temperature of about -5°C for a lager (or other drink) with about 4.5 abv (or to substantially - 4°C or substantially -6°C).

Preferably, the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion. Thus the vessel may be a glass drinking vessel.

Preferably the beverage is a pale colour for example the colour of a pale beer. If desired the beverage can be a lager, or a cider.

Aforesaid dissolved gas may comprise carbon dioxide and/or may comprise nitrogen. A dissolved nitrogen content in the beverage, for example an alcoholic beverage may be in the range of substantially zero parts per million (p.p.m) to substantially 100 p.p.m. For some beverages, for example certain lagers, substantially 40 p.p.m. A dissolved carbon dioxide content may approach zero % by volume or be greater. Said carbon dioxide may be substantially at any of the following levels or in a range defined between any of the following levels; zero vols/vol, 0.5 vols/vol, 1 vols/vol, 1.4 or 1.5 vols/vol, 2.0 vols/vol, 2.2 or 2.4 vols/vol, 3 vols/vol, 4 vols/vols or 5 vols/vol or above.

If desired, the ultrasound signals can be accompanied by a mechanically or electrically produced audible performance and/or a visible light display. The audible performance may be tuneful or musical sound. The visible light displays may comprise visible flashes of light.

If desired the beverage can be subjected to the ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

According to a seventh aspect of the invention, there is provided an alcoholic beverage comprising a water content and a dissolved gas content, wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a vessel to be drunk exposed to ambient atmospheric pressure, and wherein in said vessel aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

According to an eighth aspect of the invention, there is provided an alcoholic beverage to be available on draught and comprising a water content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a vessel open to ambient atmospheric pressure so that aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

If desired, the vessel which preferably may be a drinking vessel, can have a shape or formation to promote formation of the ice. For example, the vessel may have an internal surface to provide nucleation sites to promote formation of the ice. Said surface may have at least a surface portion which is roughened. At least a wall portion of vessel can be arranged to change colour automatically with variation in temperature. Said wall portion may comprise thermo-chromic material.

Desirably, the gas is a non-oxidising gas. This can avoid or at least slow deterioration of the beverage. The gas comprises carbon

dioxide and/or nitrogen. By cooling the beverage and forming ice therein, this appears to, initially at least, reduce the rate of release of dissolved gas from the beverage, for example lager, and appears to improve the drinking sensation, taste, flavour or bite. We believe that this is a combination of the low drinking temperature (maintained by the ice) and the greater amount of retained gas in the beverage.

The presence of the ice can provide an interesting and attractive feature which can be particularly fascinating as the ice may expand at a noticeable rate throughout the beverage after the vessel is filled. To add to the interest, the ice may include therein one or more streaks or regions of one or more colours which contrast(s) with the colour of the ice and/or beverage.

The aforesaid ice may be, or may have, the character of slush.

According to a ninth aspect of the invention, there is provided a method of serving a draught alcoholic beverage which comprises a water content and a dissolved gas content, said method comprising issuing the draught beverage from an outlet into a vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of the aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, and in said vessel aforesaid gas bubbles out of the beverage and at least a portion of said water becomes ice.

According to a tenth aspect of the invention, there is provided a method of providing a visual display or effect within a vessel having at least a portion of wall of some transparency, said method comprising providing a draught alcoholic beverage comprising a water content and a

dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure and a visual display or effect developing in the beverage in the vessel, said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becomes ice.

Formation of ice can develop in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

At least a wall portion of the vessel may change colour automatically with variation in temperature. Said wall portion may comprise thermo-chromic material.

An implement can be inserted into the beverage in the vessel to encourage formation of said ice. For example, the implement may be a thermometer, or it may be a swizzle-stick.

Colouring material or dye can be provided to form at least one coloured streak or region in the beverage and/or ice, the colour of said material or dye being in contrast to that of the ice and/or beverage so as to be visible.

The aforesaid implement may be used to add the colouring material or dye to the beverage and/or ice.

In one method, the beverage may issue at substantially -4°C into the vessel and thereafter the temperature of the beverage in the vessel may rise almost immediately to at least substantially -3°C

According to an eleventh aspect of the invention, there is provided a beverage dispense apparatus comprising cooling means adapted to cool a beverage to below 0°C, a dispense tap, and beverage dispense pipework adapted to convey the beverage to the dispense tap, the arrangement being such that the apparatus is adapted to dispense the beverage cooled to below the point at which ice would normally form in the beverage if the beverage were left standing at atmospheric pressure and if nucleation means were provided for the standing beverage, and in which the undispensed beverage in the apparatus does not freeze solid.

Preferably, the apparatus includes pump means and the beverage dispense pipework may include a portion which circulates beverage past the dispense tap when the dispense tap is closed, the fact that cooled undispensed beverage is kept flowing tends to prevent the formation of ice blockages at the dispense tap.

The beverage may be kept flowing past the dispense tap (or through it when it is open) at substantially all times that the beverage is at a temperature at which ice may otherwise form at the dispense tap or, in the beverage dispense pipework.

Preferably, there is a cold circulation loop in which is provided at least one cooling means and which is connected to the dispense tap, beverage in the circulation loop being kept cold by the cooling means and being kept circulating by pump means provided in the circulation loop. There may be a plurality of cooling means (e.g. heat exchangers) in the

circulation loop. There may be a plurality of dispense taps associated with the circulation loop.

Beverage upstream of the circulation loop may be cooled to a temperature about that at which ice may form in the beverage under the conditions of temperature and pressure experienced by the beverage in the pipework upstream of the circulation loop.

According to a twelfth aspect of the invention, there is provided apparatus to supply draught beverage, comprising beverage heat exchange means, a beverage outlet for cold beverage from said heat exchange means to issue from the outlet, openable and closable valve means to control supply of beverage to said outlet, and a beverage circulation loop for beverage to circulate in said loop.

The beverage can circulate in the loop when the valve means is closed. Preferably, the loop comprises pump means to circulate said beverage.

A purpose of circulating the beverage is to reduce the risk of or avoid freezing beverage blocking a beverage supply path to the outlet. Said loop may include a beverage flow passage in said heat exchange means.

In a preferred embodiment, the apparatus can comprise a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

A beverage flow path can connect a reservoir of the draught beverage to the heat exchange means. The flow path may comprise at least a portion of the loop.

The flow path may divide into a plurality of beverage routes, and the loop may comprise one or more of the routes.

Intermediate the reservoir and the first-mentioned heat exchange means. The beverage may be subject to the effect of second beverage cooling heat exchange means.

The reservoir may be subjected to cooling.

If desired, the second heat exchange means may act on at least a portion of the loop.

Coolant common to the first and second heat exchange means may circulate therethrough.

Beverage cooling heat exchange means may act on the beverage intermediate said reservoir and loop.

One advantage of a specific embodiment of the invention is that it enables us to provide cool beverage using ice therein in a way which a consumer may find more agreeable because dilution of the drink cannot occur. Another advantage may be that we can provide a beverage in which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

A further advantage may be that we can provide beverage in which a head thereon may be sustained for a longer period of time than is achieved by the same beer dispensed at, say 6°C, or at say 4°C using similar or the same dispense apparatus. Yet a further advantage of one embodiment of the invention is that it enables us to provide beer in which ice may develop therein as an interesting visual display.

It is extremely difficult to serve a glass of draught cider with a head of froth or foam so that the head lasts for any appreciable time. Though it is possible to create a head by dispensing the cider from a font containing a sparkler, the head quickly disappears. Because the use of a sparkler slows the delivery rate of the cider, it takes longer to deliver a measured volume than if the sparkler were not used, and because the head quickly vanishes anyway some people think use of a sparkler pointless and take if off the font - sometimes without permission.

Another object is to provide a method of serving draught cider containing a dissolved gas content so that a head on the delivered draught cider in a vessel, for example a drinking glass, is more stable and remains for a longer period of time than a head on cider served by hitherto known methods.

According to a thirteenth aspect of the invention, there is provided a method of serving draught cider in an open-topped vessel and wherein said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

The cider may be cooled to a temperature in the range of substantially -1°C to substantially -12°C. For example, the cider may be cooled to substantially -6°C. The greater the alcohol strength by volume the lower the temperature to which the cider may be cooled.

If desired, the cooled cider may issue from a dispense outlet through a sparkler. However, the cooled cider may pass through an orifice plate in a dispense outlet from which the cider issues.

Preferably the open-topped vessel is chilled before receiving the cider. The vessel may be chilled to substantially 4°C or may be chilled to a temperature lower than 4°C. For example, the vessel may be chilled to substantially 0°C.

Said ultra-sound signals may have a frequency in the range of substantially 20kHz to substantially 70kHz. For example, the ultra-sound signals may have a frequency of substantially 30kHz.

The ultra-sound signals can be applied externally of said vessel to said vessel.

The ultra-sound signals may be applied internally of said vessel to the cooled cider. Thus an ultra-sonic signal emitter may be disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

The dispense outlet from which the cooled cider issues into said vessel may be adapted to act as an ultra-sonic signal emitter to provide aforesaid ultra-sound signals. Aforesaid ultra-sound signals may be applied to aforesaid cider flowing through the dispense outlet.

The dissolved gas content may comprise carbon dioxide and/or nitrogen. The carbon dioxide may approach zero % by volume or be greater, and/or the nitrogen content may approach zero parts per million (p.p.m.) or be greater for example, the carbon dioxide content may be substantially 1.8% by volume and/or the nitrogen content may be substantially 18 parts per million (p.p.m.).

According to the fourteenth aspect of the invention there is provided cider in an open-topped vessel wherein said cider has a dissolved gas content and water content, and wherein said cider has a head of foam over ice, said ice being formed from water of said water content. In said cider according to said fourteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

According to a fifteenth aspect of the invention there is provided a method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a water content and a dissolved gas content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head. In said method according to the fifteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

The invention will now be further described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a diagrammatic view of apparatus for delivering cooled draught beverage;

Figures 2 to 4 show diagrammatically in elevation a drinking vessel filled with draught beverage delivered by the apparatus in Figure 1 to illustrate successive changes or variations in the beverage after delivery thereof into a drinking vessel;

Figure 5 to 7 respectively shows diagrammatic side elevations illustrating modifications in the way the delivered beverage may be served in the drinking vessel;

Figure 8 is a diagrammatic view showing in elevation a drinking vessel filled with a beverage delivered by the apparatus in Figure 1, the vessel being shown standing on apparatus represented diagrammatically to apply ultrasound signals to the beverage;

Figures 9 to 15 show diagrammatically in elevation successive changes in the development or variations in a head on the beverage subsequent to the beverage being subjected to ultrasound signals and also to development or variation in ice formed in the beverage;

Figure 16 is a diagrammatic view of an alternative method of applying ultrasound signals to the beverage;

Figure 17 is a diagrammatic view of yet a further method of applying ultrasound signals to the beverage;

Figure 18 shows a pint of lager being excited by ultrasound;

Figure 19 shows the pint of lager in Figure 18 after it has been allowed to stand for three minutes;

Figure 20 is a diagrammatic view of apparatus for delivering cooled draught cider;

Figure 21 is a diagrammatic view showing in elevation a drinking vessel filled with cider delivered by the apparatus in Figure 20, the vessel being shown standing on apparatus represented diagrammatically (and similar to that in Figure 8) to apply ultra-sound signals to the cider;

Figure 22 and 23 shows diagrammatically in elevation successive changes in the development of the variations in the head on the cider subsequent to the cider being subjected to ultra-sound signals and also to development of or variations in ice formed in the cider;

Figure 24 is a diagrammatic view of an alternative method of applying ultra-sound signals to the cider, and;

Figure 25 is a diagrammatic view of yet a further method of applying ultra-sound signals to the cider.

The draught beverage is stored in a keg or cask 4 which may be made of metal. The cask 4 can be stored in a cold-room known per se in public houses or clubs and/or, if desired, in a more specific cold or cooled enclosure 6, for example a tank containing a chilled mixture of water and ethylene glycol. As stated above the beverage has a water content and a dissolved gas content. This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the beverage may be within the usual known range for beverages, and the pressure within the cask 4 and the remainder of the

supply apparatus (described below) may also be within the usual known range for beverages supplied on draught.

The beverage may be a beer which term includes lager, ale, porter, or stout, or may be cider. The dissolved carbon dioxide content may be greater than substantially 1 vols/vol or 2 vols/vol and may be substantially 2.2 volumes per volume, and/or the dissolved nitrogen content may be substantially 25 p.p.m. to 35 p.p.m. If desired the carbon dioxide content may be substantially 4 vols/vol or substantially 5 vols/vol. The alcohol content may be between 2.5% abv to 6 or 7% abv, preferably 4.5% abv, ± 1% abv.

The beverage may be a flavoured alcoholic beverage.

A pump 8, arranged to operate substantially only when the manually operable valve 10 is open, is provided to pump beverage from the cask 4 along a pipe 12 ultimately to the valve 10 and a dispense outlet 14 therefrom. In known manner, a blanket or atmosphere of non-oxidising/pressurised gas (for example carbon dioxide and/or nitrogen) is provided in the cask 4 from a suitable supply 16 and assists the pump 8 in the extraction of the beverage.

A beverage dispense unit is indicated generally at 18 and has a cover indicated by interrupted lines 20. The dispense unit may be mounted at or in the vicinity of a drinks' bar - for example on the top of, or incorporated into, a counter of the bar.

In proximity to the cover 20 the pipe 12 divides into two flow paths 22 and 24, each leading to the valve 10. One is formed by piping 22a, 22b, 22c and passages 26 in heat exchangers 28a and 28b, and the other is

formed by piping 24a, 24b, 24c and passages 26 in heat exchangers 28c and 28d.

A chiller unit 30 circulates coolant through passages 32 in the heat exchangers 28 in the series by a system comprising a coolant flow pipe 34 and a coolant return pipe 36. Beverage pipes 22a and 24a can be bundled together in known manner with the coolant pipes 34 and 36 to form a python 38. The heat exchangers 28 may be plate heat exchangers.

A circulation pump 40 which may operate continuously, extends between the flow paths 22 and 24 adjacent to the junction between the pipe 12 and the flow paths. Thus, the flow paths 22, 24 and the pump 40 form a circulation loop 22, 24, 40 around which beverage is continuously circulated when valve 10 is closed.

As suggested in Figure 1, in the beverage dispense unit 18, the heat exchangers 28 are within the cover 20, whilst the valve 10 and outlet 14 can be on its exterior, and a portion of the circulation loop comprised by the pump 40 and sections of pipes 22a and 24a is also external of the cover and may be exposed to ambient temperature at the bar.

If desired, the pipe 12 may be incorporated in know manner into another cooling python 42 comprising flow and return pipes 44 and 46, carrying coolant from and back to a chiller unit 48.

Overall, the beverage arrangement - and particularly that provided by the dispense unit 18 by the heat exchangers 28 - so cools the beverage that the beverage issuing from the outlet 14 when valve 10 is opened is at a temperature below the freezing point of water at the ambient atmospheric pressure. For example the beverage may issue at a temperature in the range of substantially -1°C to substantially -12°C into

a drinking vessel or drinking glass. The range may be substantially -4°C to substantially -6°C. A target temperature of -5°C is aimed for if we use a beverage with about 4.5% abv.

When the valve 10 is closed, the beverage is circulated automatically around the loop 22, 24, 40 so it cannot stand still and start to freeze and block the supply path to valve 10.

In the case of draught beverages, for example beers, conventionally served with a head, the outlet 14 may include a known orifice plate, or other device, to promote foaming.

With reference to Figure 2, when a draught beverage 50 is delivered from the outlet 14 (Figure 1) into a drinking vessel 52 (for example a glass) the beverage is exposed to ambient atmospheric pressure and ambient or room temperature, the beverage temperature starts to increase, for example to -3°C. Almost immediately, a slug of ice 54a forms near the top of the vessel 50 at the upper level of the beverage, the ice being caused (we believe) as a result of nucleation sites resulting from the forming of bubbles of dissolved gas. If the beverage 50 has a head 56 of foam the ice forms just below the head. The or a greater part of the ice may be in the nature of slush and is formed from the water already forming the beverage. The slug of ice grows as indicated at 54b in Figure 3 and 54c in Figure 4 until it may substantially occupy the vessel 52. The growth of ice (in, say, a pint glass) can be accomplished in a minute or two, is fascinating to watch and can give rise to interesting visual effects based on the growth of the ice and the bubbling off of the gas. Another interesting visual effect is that cooled beverages delivered into a drinking vessel from the apparatus in Figure 1 swirl in the vessel for a longer time period than beverages which have not been cooled.

Not only does the formation of the ice give rise to interesting visual effects, but the existence of the ice helps to keep the drink cool longer. Also, since the ice is formed from the water in the beverage, the beverage is not diluted by the ice. In fact, for an alcoholic beverage, the overall amount of alcohol remains the same in the container when the ice forms, but since water is being used for the ice, the alcoholic strength of the remaining liquid beverages increases until the ice melts.

The vessel 52 may be shaped or formed to encourage formation of the ice. In Figure 5, a region 58 (having a rough surface) is provided to encourage formation of nucleation sites to promote formations of a further ice slug 54d which rises as indicated by arrow A to enlarge the ice slug 54 developing from the top of the vessel 52.

In Figure 6, formation of further ice 54e in the body of the beverage 50 is encouraged by the insertion therein of an elongate implement or rod 60 represented in Figure 6 by a swizzle-stick having formations 62 and 64 at its lower end and shank respectively which further encourage development of nucleation sites. In another instance, the rod 60 may be a thermometer body which can also be used to take the temperature of the drink to see if it has risen sufficiently high for it to be safe to drink. The implement can be used to push the ice around.

In Figure 7, coloured regions or streaks are shown in the ice 54 and beverage 50. These coloured formations are formed by the release of non-toxic, edible, colouring materials or dyes into the beverage 56. The colouring material or dye, which stands out visually from the ice and beverage, may be injected into the beverage, or may be introduced into the beverage by or on the aforesaid implement.

It is preferable for the vessel 52 to have a wall of sufficient transparency so that the formation of the ice slug 54 in the beverage 50 can be observed and its changing nature visually appreciated.

The drinking vessel 52 can be formed of, or have external surface areas formed of, material (for example thermo-chromic material) which automatically changes colour with temperature change. Apart from this being a further interesting visual effect, the attainment of one particular colour may signal that the beverage is at a suitable temperature for drinking.

Whilst any kind of beverage having a water and dissolved gas content may be used, we believe that lager demonstrates a visual nature or character of the invention.

With reference to Figure 8, a draught beverage 70 (which may be a beer, for example a lager) is delivered from the outlet 14 (Figure 1) into a drinking vessel 72, for example a glass which is preferably rather tall and preferably has a clear or transparent wall.

Preferably, the vessel 72 is chilled before it received the beverage. The vessel 72 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel 72 to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 74 and preferably this is some way below the top of the vessel 72 when the vessel contains a full measured volume, for example a pint of the beer.

Immediately after the cold beverage is poured into the chilled vessel 72 (or a few seconds after), the vessel is placed in a shallow depth of water 76 in a dish part 78 of an ultrasound generating apparatus 80 in which the dish 78 is securely mounted or affixed against a base part 82 containing an ultrasonic emitter 84. The emitter 84 may be arranged to emit ultrasound signals in a frequency range of substantially 20kHz to 70kHz. For example the beverage may be subject to ultrasound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 76 providing an ultrasound for any desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about three or four seconds. The user may be able to vary the length of time that the ultrasound is applied, for example by having to hold down a switch, or by altering the setting on a control.

The result in a short time (perhaps a few seconds to the order of ten seconds) is shown in Figure 9 in which the exposure to ultra-sonic signals has promoted a fairly dense sudden formation of a mass of bubbles 86 of the dissolved gas throughout the liquid beverage. This causes the head 74 to increase in height. As shown in Figure 10, the head 74 may rise out of the vessel 72. The gas bubbles form nucleation sites encouraging the quick formation of a mass of ice 88A just below the head. This ice 88A may be of a rather slushy character. For a period the mass of slush 88A grows and the head 74 rises as shown in Figure 11 but the bubbles of gas are no longer so numerous. Nevertheless, they can act as nucleation sites encouraging thereat the formation of ice 88B in the body of the beverage, this ice 88B may be more in the nature of flakes, for example snow type flakes, which rise and agglomerate to form a flaky mass 88C of ice on the underside of the slushy ice mass 88A. As

indicated in Figure 12 and 13 the ice flakes continue to form for a period, rise and extend the ice mass 88C downwards through the beverage 70.

Going from the stage shown in Figure 8 to that in Figure 14 may only take one or two minutes so the increase in gas bubbling and the formation and visible development of the ice takes place fairly quickly and can be an interesting and rather amazing phenomena to observe through the glass 72.

To enhance the theatre, drama or wonder of the event for a customer at the drinks' bar the operation of the apparatus 80 may be accompanied by an automatically (or manually actuated) occurring audible performance which may be mechanically or electrically produced using sound apparatus giving out dramatic, musical or tuneful sounds. In addition to, or as an alternative, the operation of the apparatus 80 may be, possibly automatically, accompanied by a visual lights display, for example visible flashes of light. These may stimulate flashes of lightening. In that case the audible performance may comprise noise resembling thunder.

If desired, the vessel 72 when subject to the ultrasound may be concealed from the view of the customer in a bar. For example, it may be concealed from view on one or more sides in an enclosure which may be on the counter or proximate thereto, which enclosure may be represented as a "magic" or magician's box or cabinet.

Preferably, the beverage is a pale colour. For example the beverage may be a pale coloured beer, for example a lager.

Besides the ice forming in the beverage 70 being an intriguing sight, it helps show the customer the beverage is cold and that it has not been diluted by addition of ice from water other than that of the beverage.

The good head 74 provides insulation of the ice, particularly from overhead heat, which helps sustain the ice for longer and thus the duration of its cooling effect. Also the ice below the head 74, helps sustain the existence of the head which may last for ten minutes, fifteen minutes or most preferably for twenty minutes or so.

In Figure 15, the head 74 though starting to collapse (at its centre and move away from the vessel's wall) after the elapse of some time, for example fifteen or so minutes, is still stubbornly remaining, insulating the ice and giving the beverage an attractive presentation in the vessel 72.

An alternative method of applying the ultrasound signals is represented in Figure 16 in which after the apparatus 2 in Figure 1 has dispensed a vessel or glass 72 of beverage 70 an ultrasound probe 90 powered through cable 92 is dipped into the beverage for emitter 84A to give out ultrasound signals. The probe 90 may be inserted into the beverage before the full measured amount is supplied to the vessel.

In Figure 12, the dispense outlet 14 has been arranged to act as an ultrasonic probe, for example by providing it with an ultrasonic emitter 88B.

The ultrasound probe 14 in Figure 12 may emit ultrasound signals whilst beer is passing through it to the vessel 72, and/or may become partially immersed in the beverage as shown and emit ultrasound signals

into the beverage 70 in the vessel 72 whilst the measured volume of beverage is still being supplied or after it has been supplied.

Figure 18 shows another glass 172 (for example a pint) of beverage 170 in this case lager, being excited (as indicated by arrow X) at the base only by an ultrasound emitter, for example by standing the glass of beverage in couplant (water) for example as shown in Figure 8. Figure 18 shows the glass 172 after it has been excited by the ultrasound for about three seconds or so, and whilst it is still being excited by ultrasound and whilst a head 174 of foam is beginning to form. As will be seen, in addition to general bubble formation at a relatively modest level throughout the volume of the beverage 170, there is increased activity in a series of horizontal "white bands" about half-way up the height of the glass 172. Interspersed between the white hands 120 are bands 122 which are less white-coloured i.e. more beerage or lager coloured. There are typically two to four white bands 120 visible, but increased bubble formation may occur above and below the "banded region" 120, 122.

The formation of the bands 120, 122 gives the glass of beverage an attractive appearance for the few seconds that they last. It is believed that they may be associated with the formation of standing waves in the glass 172 due to the ultrasound excitation, and may represent areas of the glass which might vibrate the most (although this belief is speculative and is not to be held to be limiting). The bands 120, 122 may form generally in the central height of the glass, but they may not be right at the middle - for example, they could be one-third to two-fifths of the way down from the top (or up from the bottom).

It should also be noted that the glass 172 of Figure 18 has a mouth 124 that is narrower than a body portion 126. It is believed that having a

restricted mouth forms a deeper and longer-lasting head. This may, or may not be associated with the fact that in comparison with the volume of beer contained a glass with a restricted mouth has a smaller exposed surface area of head than if it were in a vessel with straight sides, or outwardly flared sides.

Our trials indicate that best/better results can be achieved on pints of beverage than on half-pints of beverage. This may be associated with greater heat capacity of a pint of beverage in comparison with a half-pint of beverage, and the less effect exposure to the environment has/the less rapid the effect of the heat transfer to the local environment, when the ratio of volume of beverage; exposed surface is larger.

Figure 19, illustrates the pint of lager of Figure 18 after about three minutes have expired (or looked at another way after about ten minutes have expired - there is little change in the appearance of the glass of lager between the three minutes and the ten minutes). The head 174 is somewhat deeper than might be expected, and slightly projects above the glass 172. There is a relatively thin layer of ice 188A (of the order of a half to a few millimetres) extending under the head completely across the diameter of the glass 172 and there is a depending projection of flaky ice 188B extending down perhaps two to five centimetres into the cleared beer. The projection 188B may extend for at least three centimetres, five centimetres is not to be taken as necessarily an upper limit to its length. The projection 188B is generally central, but may be off-axis in comparison with the central axis of the glass. It has a narrower tip than it does base (the base being the portion adjacent the head 174).

It will be appreciated that creating a beverage having such an ice formation is in itself new and itself gives a visually differentiated product - which is desirable to consumers.

Moreover, creating the bands or stripes during ultrasonic excitation of the glass of beverage also creates a visually distinct product, and a differentiated mode of provision of the product to the consumer.

With reference to Figure 20 apparatus to supply cider on draught is indicated at 202.

The draught cider is stored in a keg or cask 204. As stated above, the draught cider has a water content and a dissolved gas content.

This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the cider may be within the usual known range for ciders.

The dissolved carbon dioxide content may be substantially 1.8% by volume, and/or the dissolved nitrogen content may be substantially 18 parts per million (p.p.m).

A pump 206 is provided to pump cider from the cask 204 through a non-return valve 207 and along a pipe 208 in a chilled python known per se (not shown); the pipe comprising a heat exchange coil 210 in a remote cooling system known per se. The pipe 208 leads to a chilling coil 212 in a bath 214 of a chiller 216, from which coil a pipe 208A leads to a manual valve 218 (known per se) of a dispense outlet or nozzle 220 which may be provided at or on a drinks' bar. Bath 214 contains an ethylene glycol and water cooling mixture 222, for example 50% glycol and 50%

water. The cooling mixture 222 is cooled by an evaporator 224 of a refrigeration unit 226 comprising a condenser 228, a refrigerant pump 230, and an expansion arrangement 232. A pump 234 circulates the cold mixture 222 through piping 236 forming another python 238 with the pipe 208A.

In known manner, a blanket or atmosphere of non-oxidising gas (for example carbon dioxide and/or nitrogen) from a suitable supply 240 (via a pressure regulator 242) provides a top pressure in the cask 204 and assists the pump 206 in the extraction of cider.

The top gas pressure in the cask 204 may be substantially 206.84kN/m² (30lbs/in²).

The pump 206 may develop a pressure in pipes 208, 208A of substantially 517.12kN/m² to substantially 551.58 kN/m² valve (75 to 80 lbs/in²). Normally pump 206 is not operating, thus when the valve 218 is opened the pump pressure stored in the pipes 208, 208A drops to below a pre-determined desired value which is observed by pressure switch 244 of a pump control (not shown) causing the pump 206 to operate to provide a pump output pressure of substantially 75 to 80 lbs/in². The chiller 216 is arranged to cool the cider passing through to the outlet nozzle 220 to a pre-determined temperature in the range of substantially -1°C to substantially -12°C, for example -6°C. The cider reaches the nozzle 220 at that pre-determined temperature and issues therefrom into an open-topped vessel 246 (Figure 21) which may be a drinking vessel, for example a drinking glass. In Figure 20 the cider issuing from the outlet opening of the outlet nozzle 220 passes through a sparkler 247 (known per se). Instead of or in addition to said sparkler 247, a known orifice plate

may be mounted in nozzle 220. But if desired, neither an orifice plate nor a sparkler may be fitted.

When valve 218 is closed, the pressure switch 244 observes a build-up in pressure in the pipes 208, 208A above a predetermined value and the control switches off the pump 206.

With reference to Fig 21, the draught cider 248 is delivered from the outlet 220 (Figure 20) into the drinking vessel 246, for example a glass which is preferably rather tall and preferably has a clear or transparent wall. Preferably the vessel 246 is chilled before it receives the cider. The vessel 246 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 250 when the vessel contains a full measured volume, for example a pint, of the cider.

Immediately the cold cider 248 is poured into the chilled vessel 246, the vessel is placed in a shallow depth of water 252 in a dish part 254 of an ultra-sound generating apparatus 256 in which the dish 254 is securely mounted or affixed against a base part 258 containing an ultra-sound emitter 260. The emitter 260 may be arranged to emit ultra-sound signals in a frequency range of substantially 20kHz to 70kHz. For example the cider may be subject to ultra-sound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 252 providing an ultra-sonic transmission path or coupling. The cider 248 may be subject to the ultra-sound for any desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about five seconds.

The result in a short time is shown in Figure 22 in which the exposure to ultra-sonic signals has promoted sudden formation of bubbles of dissolved gas throughout the liquid cider 248 some bubbles 252A may be relatively large whilst others 252B may be relatively small and may tend to collect linearly in wavy lines which may snake upwardly. Also the head 250 may rise to increase its height or depth. The gas bubbles form nucleation sites encouraging the quick formation of ice in the cider 248 from water of the water content of the cider. The ice rises. It may be of a slushy character and tends to agglomerate in the lower part of and below the head 250 to form a slushy mass of ice 262 such as indicated in Figure 23 in
the cider.

Going from the stage shown in Figure 21 to that in Figure 23 may only take one or two minutes so that the gas bubbling and the formation and visible development of the ice takes place fairly quickly and be interesting phenomena to observe through the glass 246.

Besides the ice forming in the cider 248 being an intriguing sight, it helps show the customer the cider is cold and that it has not been diluted by addition of ice from water other than that already in the cider.

One of the most interesting features is that the head 250 on the glass of cider may last for a considerable time, i.e. several times the duration of a head on cider arising from known methods. The head 250 may last for twenty minutes or so. Its longevity may be due to (i) the mass of ice 262 acting as a seal or barrier to gas attempting to leave the liquid cider body, and/or (ii) the fact that the ice 262 is keeping the head 250 cold.

An alternative method of applying the ultra-sound signals is represented in Figure 24, in which after the apparatus 202 in Figure 20 has dispensed a vessel or glass 246 of cider 248 an ultra-sound probe 264 powered through cable 266 is dipped into the cider for emitter 260A to give out ultra-sound signals. The probe 264 may be inserted into the cider before the full measured amount is supplied to the vessel 246.

In Figure 25, the dispense outlet 220 has been arranged to act as an ultra-sonic probe for example by providing it with an ultra-sonic emitter 260B. The ultra-sonic probe 220 in Figure 25 may emit ultra-sound signals whilst cider is passing through it to the vessel 246, and/or may become partially immersed in the cider as shown and emit ultra-sound signals into the cider 248 in the vessel 246 whilst the measured volume of cider is still being supplied or after it has been supplied.

CLAIMS

1. A beverage in an open topped vessel, said beverage comprising a water content and a dissolved gas content, and in said vessel the beverage has a head of foam over ice, said ice being formed in the beverage from water of said water content.

2. A method of keeping an alcoholic beverage in an open-topped vessel cool said beverage comprising a water content and a dissolved gas content, and said method comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

3. A method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on the beverage such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

4. A method of sustaining a head on a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content said method comprising providing said head on the beverage and forming ice in the beerage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

5. An open-topped vessel of a beverage, the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

6. A beverage as claimed in claim 1 or claim 5 or a method as claimed in any one of claims 2 to 4 in which the beverage has been subjected to the effect of ultrasound signals and the beverage is draught beverage delivered into a vessel.

7. A beverage as claimed in claim 5 or claim 6 or a method as claimed in Claim 6, in which immediately before the draught beverage is delivered into the vessel said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

8. A method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beverage to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beverage into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas bubble nucleation means.

9. A beverage as claimed in any one of claims 5 to 7, or a method as claimed in claim 8, in which the ultrasound signals are applied externally of said vessel.

10. A beverage as claimed in any one of claims 5 to 9, or a method as claimed in claim 8 or 9, in which the ultrasound signals are applied internally of said vessel to the cooled beverage.

11. A beverage as claimed in claim 10 or a method as claimed in claim 10, in which an ultrasound signal emitter is disposed in the beverage in the vessel emitting ultrasound signals into the beverage in the vessel.

12. A beverage as claimed in any one of claims 9, 10, or 11 or a method as claimed in any one of claims 9, 10, or 11, in which a dispense outlet or nozzle from which beverage is delivered into said vessel is adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals.

13. A beverage as claimed in claim 12 or a method as claimed in claim 12, in which aforesaid ultrasound signals are applied to aforesaid beverage flowing through the dispense outlet.

14. A beverage as claimed in any one of claims 5 to 13, or a method as claimed in any one of claims 6 to 13 in which the ultrasound signals have a frequency in the range of 20kHz to 70kHz.

15. A beverage or a method as claimed in claim 14, in which the ultrasound signals have a frequency of substantially 30kHz.

16. A beverage as claimed in any one of claims 1, 5, 6, 7, 9, to 15, or a method as claimed in any one of claims 2 to 4 or 8 to 14, in which a mass of said ice develops downwards in the beverage below the head.

17. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 16, or a method as claimed in any one of claims 2 to 4 or 8 to 16 in which the vessel is chilled before beverage is delivered thereinto.

18. A beverage or a method as claimed in claim 17, in which the vessel is chilled to a temperature of substantially 4°C, or the vessel is chilled to a temperature less than 4°C.

19. A beverage or a method as claimed in claim 17, in which the vessel is chilled to a temperature of substantially 0°C.

20. A beverage as claimed in claim 7 or in any one of claims 9 to 19 when appended to claim 7, or a method as claimed in claim 8 or in any one of claims 9 to 19 when appended to claim 8, in which the beverage is cooled to a temperature between substantially -1°C and substantially -12°C.

21. A beverage or a method as claimed in claim 20, in which the beverage is cooled to a temperature between substantially -4°C and substantially -6°C.

22. A beverage as claimed in any one of claims 1, 5, 6, 7, or 9 to 21 or a method as claimed in any one of claims 2 to 4 or 8 to 21 , in which the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

23. A beverage or a method as claimed in claim 22, in which the vessel is a glass drinking vessel.

24. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 23, or a method as claimed in any one of Claims 2 to 4 or 8 to 23 in which the beverage has a pale beer colour.

25. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 24 or a method as claimed in any one of claims 2 to 4 or 8 to 24 in which aforesaid dissolved gas comprises carbon dioxide and/or comprises nitrogen.

26. A beverage or a method as claimed in claim 25, in which the dissolved nitrogen content in the beverage is in the range of substantially zero parts per million (p.p.m.) to substantially 100 parts p.p.m.

27. A beverage or a method as claimed in claim 25 or in claim 26, in which the dissolved carbon dioxide content is about zero % by volume or greater.

28. A beverage or a method as claimed in claim 27, in which the carbon dioxide is substantially 2.2% or substantially 4% or substantially 5% by volume.

29. A beverage as claimed in any one of claims 5 to 7 or in any one of claims 9 to 28 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 28 when appended to claim 8, in which the ultrasound signals are accompanied by a mechanically or electrically produced audible performance and/or a visible light display.

30. A beverage or a method as claimed in claim 29, in which the audible performance is a tuneful or musical sound.

31. A beverage or a method as claimed in claim 29 or claim 30, in which
the visible light display comprises visible flashes of light.

32. A beverage as claimed in claim 6 or claim 7, or in any one of claims 9 to 32 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 31 when appended to claim 8, in which the beverage is subjected to ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

33 An alcoholic beverage comprising a water content and a dissolved gas content wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a container to be drunk exposed to ambient atmospheric pressure, and wherein in said container aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

34. An alcoholic beverage to be available on draught and comprising a water content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a container open to ambient atmospheric pressure so that the aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

35. A beverage as claimed in Claim 33 and in any one of Claims 5 to 7 or 9 to 32, or as claimed in Claim 34 and in any one of Claims 5 to 7 or 9 to 32, wherein said container is said open-topped vessel.

36. A beverage as claimed in claim 35 in which said vessel has at least a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

37. A beverage as claimed in claim 35 or claim 36 in which the vessel is made of glass.

38. A beverage as claimed in any one of claims 35 to 37, in which the vessel has a shape or formation to promote formation of said ice.

39. A beverage as claimed in any one of claims 35 to 38, in which the vessel has an internal surface arranged to provide nucleation sites to promote formation of said ice.

40. A beverage as claimed in claim 39, in which said surface has at least a surface portion which is roughened.

41. A beverage as claimed in any one of claims 35 to 40, in which the vessel has at least a wall portion arranged to change colour automatically with variations in temperature.

42. A beverage as claimed in claim 41, in which said wall portion comprises thermo-chromic material.

43. A beverage as claimed in any one claims 33 to 42 in which the formed ice includes therein one or more streaks or regions of one or more colours which contrasts(s) with the colour of the ice and/or beverage.

44. A method of serving a draught alcoholic beverage which comprises a water content and a dissolved gas content, said method comprising

issuing the draught beverage from an outlet into an open topped vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, and in said vessel aforesaid gas bubbles out of the beverage at least a portion of said water becomes ice.

45. A method of providing a visual display or effect within an open-topped vessel having at least a portion of wall of some transparency, said method comprising providing a draught alcoholic beverage comprising a water content and a dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling of the beverage which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, a visual display or effect developing in the beverage in the vessel, said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becoming ice.

46. A method as claimed in claim 44, in which the vessel has a wall portion of some transparency.

47. A method as claimed in any one of claims 44 to 46, in which the vessel comprises glass.

48. A method as claimed in any one of claims 44 to 47, in which formation of ice develops in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

49. A method as claimed in any one of claims 44 to 48, in which the vessel has at least a wall portion which changes colour automatically with variation in temperature.

50. A method as claimed in claim 49, in which said wall portion comprises thermo-chromic material.

51. A method as claimed in any one of claims 44 to 49 in which the vessel has a shape or formation to encourage the forming of the ice.

52. A method as claimed in any one of claims 44 to 51, in which the vessel has one or more internal formations to encourage the forming of the ice.

53. A method as claimed in claim 52, in which at least a portion of an internal wall of the vessel has a roughened texture.

54. A method as claimed in any one of claims 44 to 53, in which the vessel is adapted to encourage formation of further ice in the beverage below an upper layer of forming ice, and said further ice rising to joint said upper layer.

55. A method as claimed in any one of claims 44 to 54, in which an implement is inserted into the beverage in the vessel to encourage formation of said ice.

56. A method as claimed in claim 55, in which said implement is a thermometer.

57. A method as claimed in claim 56, in which said implement is a swizzle-stick.

58. A method as claimed in any one of claims 44 to 57, in which colouring material or dye is provided to form at least one coloured streak or region in the beverage and/or ice, the colour of said material or dye being in contrast to that of the ice and/or beverage so as to be visible.

59. A method as claimed in claim 58, when appended to any one of claims 47 to 57, in which said implement is used to add the colouring material or dye to the beverage and/or ice.

60. A beverage as claimed in any one of Claims 1, 5 to 7, or 9 to 43, or a method as claimed in any one of Claims 2 to 4, 8, 9 to 32 or 44 to 59, in which said ice comprises slush.

61. Apparatus to supply a draught beverage, comprising beverage cooling heat exchange means, a beverage outlet for cold beverage from said heat exchange means to issue from the outlet, openable and closable valve means to control supply of beverage to said outlet, and a beverage circulation loop for beverage to circulate in said loop.

62. Apparatus as claimed in claim 61, in which the beverage circulates in said loop when the valve means is closed.

63. Apparatus as claimed in claim 61 or claim 62, in which said loop comprises pump means to circulate beverage in the loop.

64. Apparatus as claimed in any one of claims 61 to 63, in which the beverage is circulated to reduce the risk of, or avoid, freezing beverage blocking a beverage supply path to the outlet.

65. Apparatus as claimed in any one of claims 61 to 64, in which said loop includes a beverage flow passage in said heat exchange means.

66. Apparatus as claimed in any one of claims 61 to 65, comprising a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

67. Apparatus as claimed in any one of claims 61 to 66 in which a beverage flow path connects a reservoir of said draught beverage to said heat exchange means.

68. Apparatus as claimed in claim 67, in which said flow path comprises at least a portion of said loop.

69. Apparatus as claimed in claim 67, in which said flow path divides into a plurality of beverage routes, and said loop comprises one or more of said routes.

70. Apparatus as claimed in claim 67, in which intermediate said reservoir and said first-mentioned beverage cooling heat exchange means, the beverage is subject to the effect of second beverage cooling heat exchange means.

71. Apparatus as claimed in claim 67 in which the reservoir is subjected to cooling.

72. Apparatus as claimed in any one of claims 61 to 67, in which said heat exchange means is first heat exchange means and second beverage cooling heat exchange means is provided to act on at least a portion of said loop.

73. Apparatus as claimed in claim 72, in which coolant common to the first and second heat exchange means circulates therethrough.

74. Apparatus as claimed in claim 67, in which intermediate said reservoir and said loop the beverage is subject to the effect of further beverage cooling heat exchange means.

75. Apparatus as claimed in any one of claims 61 to 74 in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature below the freezing point of water at the ambient atmospheric pressure.

76. Apparatus as claimed in any one of claims 61 to 74, in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature of between substantially -1°C and substantially -12°C.

77. A beverage as claimed in Claim 1 or Claim 5 or as claimed in any one of Claims 6, 7, 9 to 32 or 60 when any one is appended to Claim 1 or Claim 5, or a method as claimed in Claim 3 or Claim 4 or as claimed in any one of Claims 6 to 8 or 9 to 32 when any one is appended to Claim 3 or Claim 4, or an apparatus to supply a beverage as claimed in any one of Claims 61 to 76, in which the beverage is non-alcoholic.

78. A beverage as claimed in Claim 1 or Claim 5 or as claimed in any one of Claims 6, 7, 9 to 32 or 60 when any one is appended to Claim 1 or Claim 5, or a method as claimed in any one of Claims 6 to 8 or 9 to 32 when any one is appended to Claim 3 or Claim 4, or an apparatus to

supply a beverage as claimed in any one of Claims 61 to 76, in which the beverage is alcoholic.

79. A beverage, a method or an apparatus as claimed in Claim 78 in which said alcoholic beverage is a beer.

80. A beverage, a method or an apparatus as claimed in Claim 76 or Claim 77, in which said beer is a lager.

81. A beverage, a method or an apparatus as claimed in Claim 78, in which said alcoholic beverage is a cider.

82. A method of serving draught cider in an open-topped vessel and wherein said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

83. A method as claimed in Claim 82, in which the cider is cooled to a temperature in the range of substantially -1°C to substantially -12°C.

84. A method as claimed in Claim 83, in which the cider is cooled to a temperature of substantially -6°C.

85. A method as claimed in any one of Claims 82 to 84, in which the cooled cider issues from a dispense outlet through a sparkler.

86. A method as claimed in any one of Claims 82 to 84, in which the cooled cider passes through an orifice plate in a dispense outlet from which the cider issues.

87. A method as claimed in any one of Claims 82 to 86, in which the open-topped vessel is chilled before receiving the cider.

88. A method as claimed in Claim 87, in which the open-topped vessel is chilled to substantially 4°C or chilled to a temperature lower than 4°C.

89. A method as claimed in Claim 88, in which the open-topped vessel is chilled to substantially 0°C.

90. A method as claimed in any one of Claims 82 to 89, in which said ultra-sound signals have a frequency in the range of substantially 20kHz to substantially 70 kHz.

91. A method as claimed in Claim 90, in which the ultra-sound signals have a frequency of substantially 30kHz.

92. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied externally of said vessel to said vessel.

93. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied internally of said vessel to the cooled cider.

94. A method as claimed in Claim 93 in which an ultra-sonic signals emitter is disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

95. A method as claimed in Claim 93 or 94, in which a or the dispense outlet from which the cooled cider issues into said vessel is adapted to act as an ultra-sonic signal emitter to produce aforesaid ultra-sound signals.

96. A method as claimed in Claim 95, in which aforesaid ultra-sound signals are applied to aforesaid cider flowing through the dispense outlet.

97. A method as claimed in any one of Claims 82 to 96, in which the dissolved gas content comprises carbon dioxide and/or nitrogen.

98. A method as claimed in Claim 97, in which the carbon dioxide content is substantially zero % by volume or greater and/or the nitrogen content is substantially zero parts per million (p.p.m.) or greater.

99. Cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, and wherein said cider has a head of foam over ice, said ice being formed in the cider from water of said water content.

100. Cider as claimed in Claim 99, in which said head and ice are produced at least in part by performance of a method as claimed in any one of claims 82 to 98.

101. A method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head.

102. A method as claimed in Claim 101, in which said head and ice are produced at least in part by performance of a method as claimed in any one of Claims 82 to 98.

103. A beverage as claimed in any one of Claims 78 to 81, in which the beverage comprises 2.5% to 7% alcohol by volume (abv).

104. A beverage as claimed in Claim 103, in which the beverage comprises 3.5% to 5.5% abv.

105. A beverage as claimed in any one of Claims 77 to 81 or 103 or 10, in which the beverage is a draught beverage.

106. A beverage as claimed in Claim 1 and substantially as hereinbefore described with reference to Figures 1 to 19 or Figures 20 to 25 of the accompanying drawings.

107. A method of keeping a beverage in an open-topped vessel cool, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24 or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 of the accompanying drawings.

108. A method of sustaining cooling ice in a beverage in an open-topped vessel and wherein said ice is formed in the beverage from water of a water content of the beverage, said method being substantially as

hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

109. A method of sustaining a head on a beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

110. A method of serving draught beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25.

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
C12H 1/18, B67D 1/04

A1

(11) International Publication Number: WO 99/60092

(43) International Publication Date: 25 November 1999 (25.11.99)

(21) International Application Number: PCT/GB99/01551

(22) International Filing Date: 14 May 1999 (14.05.99)

(30) Priority Data:

9810309.6	15 May 1998 (15.05.98)	GB
9828321.1	23 December 1998 (23.12.98)	GB
9828317.9	23 December 1998 (23.12.98)	GB
9901018.3	19 January 1999 (19.01.99)	GB

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(81) Designated States: AU, CA, GB, JP, NO, SG, US, ZA, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A BEVERAGE

(57) Abstract

A draught beverage (170) which may be alcoholic or non–alcoholic, for example a lager or cider in an open–topped drinking vessel or glass (172). The beverage comprises a water content and dissolved gas content. The draught beverage is dispensed from a font at a cooled temperature below the freezing point of water at ambient atmospheric pressure. The dispense temperature may be in the range of –1 °C to –12 °C. The beverage in the glass may or may not be subjected to external excitement energy, for example ultrasound, to encourage formation of nucleation sites in the beverage. Either way dissolved gas bubbles out of the beverage causing occurrence of nucleation sites at which ice (188A, 188B) from the water content forms. At least in part the ice has a slushy character. A head (174) also forms on the dispensed draught beverage and below the head the ice (188A, 188B) locates and develops downwards into the beverage.

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A Beverage

This invention relates to a beverage, to methods of presenting or serving a beverage, to providing a visual display in a beverage, and to apparatus to supply draught beverage.

The beverage concerned comprises a water content and a dissolved gas content.

The beverage may be an alcoholic beverage or a non-alcoholic beverage. For example, the beverage may be a beer, a cider, a flavoured alcoholic beverage, for example an alcoholic lemonade or other alco-pop style of drink, or a so-called low alcoholic drink. The term "beer" embraces lager, ale, porter and stout and includes a beverage comprising hops flavouring, an alcohol content derived from malt and fermentation, a water content, and a dissolved gas content.

One object is to provide a cool beverage using ice therein in a way which a consumer may find more agreeable because dilution of the drink cannot occur.

Another object to provide a beverage which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

Another object is to provide a beverage in which a head thereon may be sustained.

Another object is to provide a beverage in which ice may develop therein as an interesting visual display.

According to a first aspect of the invention there is provided a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and in said vessel the beverage having a head of foam over ice, said ice being formed in the beverage from water of said water content.

The vessel may be any suitable vessel, for example a drinking vessel, for example a glass.

Preferably there is a layer of ice adjacent the head, in contact with the head. Preferably there is a projection of ice extending downwards, away from the head, and being provided in the region of the head. The projection of the ice may depend directly from the head, or from a layer of ice beneath the head.

The ice is preferably made of many small crystals of ice, rather than a single solid mass. The ice is preferably slushy in character, rather than being a solid mass. There may be more than one kind of ice formation in the beverage. There may be a fine, powdery ice. There may be a flaky ice, of the order of 1 or 2mm or 3mm or 4mm, or more, in their longest dimension of the flakes.

The beverage, which may be coloured as distinct from white or water clear, may have bands, or stripes, across it at different heights, the bands possibly being white layers where nucleation is taking place, and beverage-coloured layers interposed between the white layers where less nucleation is taking place. This effect may be achieved by using ultrasound on the vessel, for example a glass, of beverage. The white bands and the

interposed beverage-coloured bands may be of substantially the same thickness.

The white bands interspersed by beverage-coloured bands may exist for a matter of seconds, rather than minutes, and typically exist for 1 to 10 seconds, preferably about 3 to 6 seconds. The white bands/beverage-coloured bands interspersed may exist for substantially the same time as ultrasound is applied to the vessel of beverage.

Nucleation means may be provided to encourage the formation of the ice crystals and/or head in the beverage when it is in a vessel. The nucleation means is preferably the administration of ultrasound, preferably to the bottom portion of a vessel of beverage, but it could be other forms of nucleation inducement. For example the vessel and/or dispense tap/nozzle (or an object to be inserted into the vessel of beverage) may have a roughened surface/high surface area surface to encourage nucleation (such as a sintered surface, etched surface, or a surface of ground material, such as glass); or a rapid and suitably large pressure drop may be provided to induce nucleation; or mechanical agitation may be provided; or the beverage may be arranged to have turbulent flow to promote nucleation; or an amount of liquid, possibly highly supersaturated with gas, may be introduced or injected; or gas may be otherwise introduced, or injected, or the glass may be vibrated in some way (e.g. by being exposed to sound waves, or the vessel may be vibrated in some other way); or by introducing a chemical (e.g. tablet) or device which generates bubbles (for example a chemical pellet may effervesce or dissolve, releasing bubbles).

According to a second aspect of the invention there is provided a method of keeping a beverage in an open-topped vessel cool, said beverage comprising a water content and a dissolved gas content. and said method

comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

According to a third aspect of the invention there is provided a method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on the beverage such that in the vessel said ice is covered by the head which acts as head insulation above the ice against heat directed towards the ice from above the head.

According to a fourth aspect of the invention there is provided a method of sustaining a head on beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, said method comprising providing a head on the beverage and forming ice in the beverage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

According to a fifth aspect of the invention, there is provided an open-topped vessel of a beverage the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

Preferably the vessel has a transparent or translucent wall or at least has a window of transport or translucent material.

Preferably the ice formation extends substantially the width of the mouth of the vessel, or completely across the width of the mouth. It may comprise substantially homogenous ice-crystals in a head-contacting region or layer. Alternatively, the ice crystals that contact the head may not be substantially homogeneous.

The ice formation may have a projection extending away from the head. The projection may comprise flakes of ice that are larger than the ice at the ice-head boundary.

The ice at the ice-head interface may have been formed before the ice flakes of the projection.

The beverage may have been subjected to ultrasound signals and may be draught beverage delivered into the vessel. Before the draft beverage is delivered into the vessel, and preferably immediately before, the beverage may be cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

According to a sixth aspect of the invention there is provided a method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beverage to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beveage into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas bubble nucleation means.

The ultrasound signals may be applied externally of said vessel, and/or the ultrasound signals may be applied internally of said vessel to the

cooled beverage. In the latter case an ultra-sonic emitter provided as or incorporated into a probe may be disposed in the beverage in the vessel. If desired a dispense outlet or nozzle from which the beverage is delivered into the vessel may be adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals to beverage in the vessel. Such signals may be applied to the beverage as it passes through the dispense outlet.

Ultrasound signals can be applied to beverage not only after it has been delivered into the vessel, but also whilst it is being delivered.

The ultrasound signals may have a frequency in the range of 20kHz to 70kHz. For example, the ultrasound signals may have a frequency of substantially 30kHz.

A mass of aforesaid ice may develop downwards in the beverage below the head.

Preferably, the vessel is chilled before the beverage is delivered thereinto. The vessel may be chilled to a temperature of substantially 4°C, or the vessel may be chilled to a temperature less than 4°C. For example, the vessel may be chilled to a temperature of substantially 0°C.

Prior to the delivery, and preferably just prior to the delivery, a draught beverage may be cooled to a temperature in a range of between substantially -1°C and substantially -12°C and may issue at a temperature substantially in that range into the vessel. If desired, the beverage may be cooled to a temperature between substantially -4°C and substantially -6°C. The greater the alcohol strength by volume (abv). the lower the temperature to which the alcoholic beverage may be cooled. We may aim to achieve a

dispense temperature of about -5°C for a lager (or other drink) with out 4.5 abv (or to substantially - 4°C or substantially -6°C).

Preferably, the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion. Thus the vessel may be a glass drinking vessel.

Preferably the beverage is a pale colour for example the colour of a pale beer. If desired the beverage can be a lager, or a cider.

Aforesaid dissolved gas may comprise carbon dioxide and/or may comprise nitrogen. A dissolved nitrogen content in the beverage, for example an alcoholic beverage may be in the range of substantially zero parts per million (p.p.m) to substantially 100 p.p.m. For some beverages, for example certain lagers, substantially 40 p.p.m. A dissolved carbon dioxide content may approach zero % by volume or be greater. Said carbon dioxide may be substantially at any of the following levels or in a range defined between any of the following levels; zero vols/vol, 0.5 vols/vol, 1 vols/vol, 1.4 or 1.5 vols/vol, 2.0 vols/vol, 2.2 or 2.4 vols/vol, 3 vols/vol, 4 vols/vols or 5 vols/vol or above.

If desired, the ultrasound signals can be accompanied by a mechanically or electrically produced audible performance and/or a visible light display. The audible performance may be tuneful or musical sound. The visible light displays may comprise visible flashes of light.

If desired the beverage can be subjected to the ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

According to a seventh aspect of the invention, there is provided a beverage comprising a water content and a dissolved gas content, wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a vessel to be drunk exposed to ambient atmospheric pressure, and wherein in said vessel aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

According to an eighth aspect of the invention, there is provided a beverage to be available on draught and comprising a water content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a vessel open to ambient atmospheric pressure so that aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

If desired, the vessel which preferably may be a drinking vessel, can have a shape or formation to promote formation of the ice. For example, the vessel may have an internal surface to provide nucleation sites to promote formation of the ice. Said surface may have at least a surface portion which is roughened. At least a wall portion of vessel can be arranged to change colour automatically with variation in temperature. Said wall portion may comprise theremo-chromic material.

Desirably, the gas is a non-oxidising gas. This can avoid or at least slow deterioration of the beverage. The gas comprises carbon dioxide and/or nitrogen. By cooling the beverage and forming ice therein, this appears to, initially at least, reduce the rate of release of dissolved gas from the beverage, for example lager, and appears to improve the drinking sensation, taste, flavour or bite. We believe that this is a combination of

the low drinking temperature (maintained by the ice) and the greater amount of retained gas in the beverage.

The presence of the ice can provide an interesting and attractive feature which can be particularly fascinating as the ice may expand at a noticeable rate throughout the beverage after the vessel is filled. To add to the interest, the ice may include therein one or more streaks or regions of one or more colours which contrast(s) with the colour of the ice and/or beverage.

The aforesaid ice may be, or may have, the character of slush.

According to a ninth aspect of the invention, there is provided a method of serving a draught beverage which comprises a water content and a dissolved gas content, said method comprising issuing the draught beverage from an outlet into a vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of the aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, and in said vessel aforesaid gas bubbles out of the beverage and at least a portion of said water becomes ice.

According to a tenth aspect of the invention, there is provided a method of providing a visual display or effect within a vessel having at least a portion of wall of some transparency, said method comprising providing a draught beverage comprising a water content and a dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient

atmospheric pressure and a visual display or effect developing in the beverage in the vessel, said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becomes ice.

Formation of ice can develop in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

At least a wall portion of the vessel may change colour automatically with variation in temperature. Said wall portion may comprise thermochromic material.

An implement can be inserted into the beverage in the vessel to encourage formation of said ice. For example, the implement may be a thermometer, or it may be a swizzle-stick.

Colouring material or dye can be provided to form at least one coloured streak or region in the beverage and/or ice, the colour of said material or dye being in contrast to that of the ice and/or beverage so as to be visible.

The aforesaid implement may be used to add the colouring material or dye to the beverage and/or ice.

In one method, the beverage may issue at substantially -4°C into the vessel and thereafter the temperature of the beverage in the vessel may rise almost immediately to at least substantially -3°C

According to an eleventh aspect of the invention, there is provided a beverage dispense apparatus comprising cooling means adapted to cool a beverage to below 0°C, a dispense tap, and beverage dispense pipework adapted to convey the beverage to the dispense tap, the arrangement being such that the apparatus is adapted to dispense the beverage cooled to below the point at which ice would normally form in the beverage if the beverage were left standing at atmospheric pressure and if nucleation means were provided for the standing beverage, and in which the undispensed beverage in the apparatus does not freeze solid.

Preferably, the apparatus includes pump means and the beverage dispense pipework may include a portion which circulates beverage past the dispense tap when the dispense tap is closed, the fact that cooled undispensed beverage is kept flowing tends to prevent the formation of ice blockages at the dispense tap.

The beverage may be kept flowing past the dispense tap (or through it when it is open) at substantially all times that the beverage is at a temperature at which ice may otherwise form at the dispense tap or, in the beverage dispense pipework.

Preferably, there is a cold circulation loop in which is provided at least one cooling means and which connected to the dispense tap, beverage in the circulation loop being kept cold by the cooling means and being kept circulating by pump means provided in the circulation loop. There may be a plurality of cooling means (e.g. heat exchangers) in the circulation loop. There may be a plurality of dispense taps associated with the circulation loop.

Beverage upstream of the circulation loop may be cooled to a temperature about that at which ice may form in the beverage under the conditions of temperature and pressure experienced by the beverage in the pipework upstream of the circulation loop.

According to a twelfth aspect of the invention, there is provided apparatus to supply draught beverage, comprising beverage heat exchange means, a beverage outlet for cold beverage from said heat exchange means to issue form the outlet, openable and closable valve means to control supply of beverage to said outlet, and a beverage circulation loop for beverage to circulate in said loop.

The beverage can circulate in the loop when the valve means is closed. Preferably, the loop comprises pump means to circulate said beverage.

A purpose of circulating the beverage is to reduce the risk of or avoid freezing beverage blocking a beverage supply path to the outlet. Said loop may include a beverage flow passage in said heat exchange means.

In a preferred embodiment, the apparatus can comprise a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

A beverage flow path can connect a reservoir of the draught beverage to the heat exchange means. The flow path may comprise at least a portion of the loop.

The flow path may divide into a plurality of beverage routes, and the loop may comprise one or more of the routes.

Intermediate the reservoir and the first-mentioned heat exchange means. The beverage may be subject to the effect of second beverage cooling heat exchange means.

The reservoir may be subjected to cooling.

If desired, the second heat exchange means may act on at least a portion of the loop.

Coolant common to the first and second heat exchange means may circulate therethrough.

Beverage cooling heat exchange means may act on the beverage intermediate said reservoir and loop.

One advantage of a specific embodiment of the invention is that it enables us to provide cool beverage using ice therein in a way which a consumer may find more agreeable because dilution of the drink cannot occur. Another advantage may be that we can provide a beverage in which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

A further advantage may be that we can provide beverage in which a head thereon may be sustained for a longer period of time than is achieved by the same beer dispensed at, say 6°C, or at say 4°C using similar or the same dispense apparatus. Yet a further advantage of one embodiment of the invention is that it enables us to provide beer in which ice may develop therein as an interesting visual display.

It is extremely difficult to serve a glass of draught cider with a head of froth or foam so that the head lasts for any appreciable time. Though it is possible to create a head by dispensing the cider from a font containing a sparkler, the head quickly disappears. Because the use of a sparkler slows the delivery rate of the cider, it takes longer to deliver a measured volume than if the sparkler were not used, and because the head quickly vanishes anyway some people think use of a sparkler pointless and take if off the font - sometimes without permission.

Another object is to provide a method of serving draught cider containing a dissolved gas content so that a head on the delivered draught cider in a vessel, for example a drinking glass, is more stable and remains for a longer period of time than a head on cider served by hitherto known methods.

According to a thirteenth aspect of the invention, there is provided a method of serving draught cider in an open-topped vessel and wherein said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

The cider may be cooled to a temperature in the range of substantially on -1°C to substantially -12°C. For example, the cider may be cooled to substantially -6°C. The greater the alcohol strength by volume the lower the temperature to which the cider may be cooled.

If desired, the cooled cider may issue from a dispense outlet through a sparkler. However, the cooled cider may pass through an orifice plate in a dispense outlet from which the cider issues.

Preferably the open-topped vessel is chilled before receiving the cider. The vessel may be chilled to substantially 4°C or may be chilled to a temperature lower than 4°C. For example, the vessel may be chilled to substantially 0°C.

Said ultra-sound signals may have a frequency in the range of substantially 20kHz to substantially 70kHz. For example, the ultra-sound signals may have a frequency of substantially 30kHz.

The ultra-sound signals can be applied externally of said vessel to said vessel.

The ultra-sound signals may be applied internally of said vessel to the cooled cider. Thus an ultra-sonic signal emitter may be disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

A or the dispense outlet from which the cooled cider issues into said vessel may be adapted to act as an ultra-sonic signal emitter to provide aforesaid ultra-sound signals. Aforesaid ultra-sound signals may be applied to aforesaid cider flowing through the dispense outlet.

The dissolved gas content may comprise carbon dioxide and/or nitrogen. The carbon dioxide may approach zero % by volume or be greater, and/or the nitrogen content may approach zero parts per million (p.p.m.) or be greater for example, the carbon dioxide content may be

substantially 1.8% by volume and/or the nitrogen content may be substantially 18 parts per million (p.p.m.).

According to the fourteenth aspect of the invention there is provided cider in an open-topped vessel wherein said cider has a dissolved gas content and water content, and wherein said cider has a head of foam over ice, said ice being formed from water of said water content. In said cider according to said fourteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

According to a fifteenth aspect of the invention there is provided a method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a water content and a dissolved gas content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head. In said method according to the fifteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

The invention will now be further described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a diagrammatic view of apparatus for delivering cooled draught beverage;

Figures 2 to 4 show diagrammatically in elevation a drinking vessel filled with draught beverage delivered by the apparatus in Figure 1 to illustrate successive changes or variations in the beverage after delivery thereof into a drinking vessel;

Figure 5 to 7 respectively shows diagrammatic side elevations illustrating modifications in the way the delivered beverage may be served in the drinking vessel;

Figure 8 is a diagrammatic view showing in elevation a drinking vessel filled with a beverage delivered by the apparatus in Figure 1, the vessel being shown standing on apparatus represented diagrammatically to apply ultrasound signals to the beverage;

Figure 9 to 15 shows diagrammatically in elevation successive changes in the development or variations in a head on the beverage subsequent to the beverage being subjected to ultrasound signals and also to development or variation in ice formed in the beverage;

Figure 16 is a diagrammatic view of an alternative method of applying ultrasound signals to the beverage;

Figure 17 is a diagrammatic view of yet a further method of applying ultrasound signals to the beverage;

Figure 18 shows a pint of lager being excited by ultrasound;

Figure 19 shows the pint of lager in Figure 18 after it has been allowed to stand for three minutes;

Figure 20 is a diagrammatic view of apparatus for delivering cooled draught cider;

Figure 21 is a diagrammatic view showing in elevation a drinking vessel filled with cider delivered by the apparatus in Figure 20, the vessel being shown standing on apparatus represented diagrammatically (and similar to that in Figure 8) to apply ultra-sound signals to the cider;

Figure 22 and 23 shows diagrammatically in elevation successive changes in the development of the variations in the head on the cider subsequent to the cider being subjected to ultra-sound signals and also to development of or variations in ice formed in the cider;

Figure 24 is a diagrammatic view of an alternative method of applying ultra-sound signals to the cider, and;

Figure 25 is a diagrammatic view of yet a further method of applying ultra-sound signals to the cider.

The draught beverage is stored in a keg or cask 4 which may be made of metal. The cask 4 can be stored in a cold-room known per se in public houses or clubs and/or, if desired, in a more specific cold or cooled enclosure 6, for example a tank contained a chilled mixture of water and ethylene glycol. As stated above the beverage has a water content and a dissolved gas content. This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the beverage may be within the usual known range for beverages, and the pressure within the cask 4 and the remainder of the supply apparatus (described below) may also be within the usual known range for beverages supplied on draught.

The beverage may be a beer which term includes lager, ale, porter, or stout, or may be cider. The dissolved carbon dioxide content may be

greater than substantially 1 vols/vol or 2 vols/vol and may be substantially 2.2 volumes per volume, and/or the dissolved nitrogen content may be substantially 25 p.p.m. to 35 p.p.m. If desired the carbon dioxide content may be substantially 4 vols/vol or substantially 5 vols/vol. The alcohol content may be between 2.5% abv to 6 or 7% abv, preferably 4-5% abv, ± 1% abv.

The beverage may be a flavoured alcoholic beverage.

A pump 8, arranged to operate substantially only when the manually operable valve 10 is open, is provided to pump beverage from the cask 4 along a pipe 12 ultimately to the valve 10 and a dispense outlet 14 therefrom. In known manner, a blanket or atmosphere of non-oxidising/pressurised gas (for example carbon dioxide and/or nitrogen) is provided in the cask 4 from a suitable supply 16 and assists the pump 8 in the extraction of the beverage.

A beverage dispense unit is indicated generally at 18 and has a cover indicated by interrupted lines 20. The dispense unit may be mounted at or in the vicinity of a drinks' bar - for example on the top of, or incorporated into, a counter of the bar.

In proximity to the cover 20 the pipe 12 divides into two flow paths 22 and 24, each leading to the valve 10. One is formed by piping 22a, 22b, 22c and passages 26 in heat exchangers 28a and 28b, and the other is formed by piping 24a, 24b, 24c and passages 26 in heat exchangers 28c and 28d.

A chiller unit 30 circulates coolant through passages 32 in the heat exchangers 28 in the series by a system comprising a coolant flow pipe 34

and a coolant return pipe 36. Beverage pipes 22a and 24a can be bundled together in known manner with the coolant pipes 34 and 36 to form a python 38. The heat exchangers 28 may be plate heat exchangers.

A circulation pump 40 which may operate continuously, extends between the flow paths 22 and 24 adjacent to the junction between the pipe 12 and the flow paths. Thus, the flow paths 22, 24 and the pump 40 form a circulation loop 22, 24, 40 around which beverage is continuously circulated when valve 10 is closed.

As suggested in Figure 1, in the beverage dispense unit 18, the heat exchangers 28 are within the cover 20, whilst the valve 10 and outlet 14 can be on its exterior, and a portion of the circulation loop comprised by the pump 40 and sections of pipes 22a and 24a is also external of the cover and may be exposed to ambient temperature at the bar.

If desired, the pipe 12 may be incorporated in know manner into another cooling cooling python 42 comprising flow and return pipes 44 and 46, carrying coolant from and back to a chiller unit 48.

Overall, the beverage arrangement - and particularly that provided by the dispense unit 18 by the heat exchangers 28 - so cools the beverage that the beverage issuing from the outlet 14 when valve 10 is opened at a temperature below the freezing point of water at the ambient atmospheric pressure. For example the beverage may issue at a temperature in the range of substantially -1°C to substantially -12°C into a drinking vessel or drinking glass. The range may be substantially -4°C to substantially -6°C. A target temperature of -5°C is aimed for if we use a beverage with about 4.5% abv.

When the valve 10 is closed, the beverage is circulated automatically around the loop 22, 24, 40 so it cannot stand still and start to freeze and block the supply path to valve 10.

In the case of draught beverages, for example beers, conventionally served with a head, the outlet 14 may include a known orifice plate, or other device, to promote foaming.

With reference to Figure 2, when a draught beverage 50 is delivered from the outlet 14 (Figure 1) into a drinking vessel 52 (for example a glass) the beverage is exposed to ambient atmospheric pressure and ambient or room temperature, the beverage temperature starts to increase, for example to -3°C. Almost immediately, a slug of ice 54a forms near the top of the vessel 50 at the upper level of the beverage, the ice being caused (we believe) as a result of nucleation sites resulting from the forming of bubbles of dissolved gas. If the beverage 50 has a head 56 of foam the ice forms just below the head. The or a greater part of the ice may be in the nature of slush and is formed from the water already forming the beverage. The slug of ice grows as indicated at 54b in Figure 3 and 54c in Figure 4 until it may substantially occupy the vessel 52. The growth of ice (in, say, a pint glass) can be accomplished in a minute or two, is fascinating to watch and can give rise to interesting visual effects based on the growth of the ice and the bubbling off of the gas. Another interesting visual effect is that cooled beverages delivered into a drinking vessel from the apparatus in Figure 1 swirl in the vessel for a longer time period than beverages which have not been cooled.

Not only does the formation of the ice give rise to interesting visual effects, but the existence of the ice helps to keep the drink cool longer. Also, since the ice is formed from the water in the beverage, the beverage is

not diluted by the ice. In fact, for an alcoholic beverage, the overall amount of alcohol remains the same in the container when the ice forms, but since water is being used for the ice, the alcoholic strength of the remaining liquid beverages increases until the ice melts.

The vessel 52 may be shaped or formed to encourage formation of the ice. In Figure 5, a region 58 (having a rough surface) is provided to encourage formation of nucleation sites to promote formations of a further ice slug 54d which rises as indicated by arrow A to enlarge the ice slug 54 developing from the top of the vessel 52.

In Figure 6, formation of further ice 54e in the body of the beverage 50 is encouraged by the insertion therein of an elongate implement or rod 60 represented in Figure 6 by a swizzle-stick having formations 62 and 64 at its lower end and shank respectively which further encourage development of nucleation sites. In another instance, the rod 60 may be a thermometer body which can also be used to take the temperature of the drink to see if it has risen sufficiently high for it to be safe to drink. The implement can be used to push the ice around.

In Figure 7, coloured regions or streaks are shown in the ice 54 and beverage 50. These coloured formations are formed by the release of non-toxic, edible, colouring materials or dyes into the beverage 56. The colouring material or dye, which stands out visually form the ice and beverage, may be injected into the beverage, or may be introduced into the beverage by or on the aforesaid implement.

It is preferable for the vessel 52 to have a wall of sufficient transparency so that the formation of the ice slug 54 in the beverage 50 can be observed and its changing nature visually appreciated.

The drinking vessel 52 can be formed of, or have external surface areas formed of, material (for example thermo-chromic material) which automatically changes colour with temperature change. Apart from this being a further interesting visual effect, the attainment of one particular colour may signal that the beverage is at a suitable temperature for drinking.

Whilst any kind of beverage having a water and dissolved gas content may be used, we believe that lager demonstrates a visual nature or character of the invention.

With reference to Figure 8, a draught beverage 70 (which may be a beer, for example a lager) is delivered from the outlet 14 (Figure 1) into a drinking vessel 72, for example a glass which is preferably rather tall and preferably has a clear or transparent wall.

Preferably, the vessel 72 is chilled before it received the beverage. The vessel 72 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel 72 to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 74 and preferably this is some way below the top of the vessel 72 when the vessel contains a full measured volume, for example a pint of the beer.

Immediately after the cold beverage is poured into the chilled vessel 72 (or a few seconds after), the vessel is placed in a shallow depth of water 76 in a dish part 78 of an ultrasound generating apparatus 80 in which the dish 78 is securely mounted or affixed against a base part 82 containing an ultrasonic emitter 84. The emitter 84 may be arranged to emit ultrasound signals in a frequency range of substantially 20kHz to 70kHz. For example

the beverage may be subject to ultrasound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 76 providing an ultrasound for any desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about three or four seconds. The user may be able to vary the length of time that the ultrasound is applied, for example by having to hold down a switch, or by altering the setting on a control.

The result in a short time (perhaps a few seconds to the order of ten seconds) is shown in Figure 9 in which the exposure to ultra-sonic signals has promoted a fairly dense sudden formation of a mass of bubbles 86 of the dissolved gas throughout the liquid beverage. This causes the head 74 to increase in height. As shown in Figure 10, the head 74 may rise out of the vessel 72. The gas bubbles form nucleation sites encouraging the quick formation of a mass of ice 88A just below the head. This ice 88A may be of a rather slushy character. For a period the mass of slush 88A grows and the head 74 rises as shown in Figure 11 but the bubbles of gas are no longer so numerous. Nevertheless, they can act as nucleation sites encouraging there at the formation of ice 88B in the body of the beverage, this ice 88B may be more in the nature of flakes, for example snow type flakes, which rise and agglomerate to form a flaky mass 88C of ice on the underside of the slushy ice mass 88A. As indicated in Figure 12 and 13 the ice flakes continue to form for a period, rise and extend the ice mass 88C downwards through the beverage 70.

Going from the stage shown in Figure 8 to that in Figure 14 may only take one or two minutes so the increase in gas bubbling and the formation and visible development of the ice takes place fairly quickly and can be interesting and rather amazing phenomena to observe through the glass 72.

To enhance the theatre, drama or wonder of the event for a customer at the drinks' bar the operation of the apparatus 80 may be accompanied by an automatically (or manually actuated) occurring audible performance which may be mechanically or electrically produced using sound apparatus giving out dramatic, musical or tuneful sounds. In addition to, or as an alternative, the operation of the apparatus 80 may be, possibly automatically, accompanied by a visual lights display, for example visible flashes of light. These may stimulate flashes of lightening. In that case the audible performance may comprise noise resembling thunder.

If desired, the vessel 72 when subject to the ultrasound may be concealed from the view of the customer in a bar. For example, it may be concealed from view on one or more sides in an enclosure which may be on the counter or proximate thereto, which enclosure may be represented as a "magic" or magician's box or cabinet.

Preferably, the beverage is a pale colour. For example the beverage may be a pale coloured beer, for example a lager.

Besides the ice forming in the beverage 70 being an intriguing sight, it helps show the customer the beverage is cold and that it has not been diluted by addition of ice from water other than that of the beverage.

The good head 74 provides insulation of the ice, particularly from overhead heat, which helps sustain the ice for longer and thus the duration of its cooling effect. Also the ice below the head 74, helps sustain the existence of the head which may last for ten minutes, fifteen minutes or most preferably for twenty minutes or so.

In Figure 15, the head 74 though starting to collapse (at its centre and move away from the vessel's wall) after the elapse of some time, for example fifteen or so minutes, is still stubbornly remaining, insulating the ice and giving the beverage an attractive presentation in the vessel 72.

An alternative method of applying the ultrasound signals is represented in Figure 16 in which after the apparatus 2 in Figure 1 has dispensed a vessel or glass 72 of beverage 70 an ultrasound probe 90 powered through cable 92 is dipped into the beverage for emitter 84A to give out ultrasound signals. The probe 90 may be inserted into the beverage before the full measured amount is supplied to the vessel.

In Figure 12, the dispense outlet 14 has been arranged to act as an ultrasonic probe, for example by providing it with an ultrasonic emitter 88B.

The ultrasound probe 14 in Figure 12 may emit ultrasound signals whilst beer is passing through it to the vessel 72, and/or may become partially immersed in the beverage as shown and emit ultrasound signals into the beverage 70 in the vessel 72 whilst the measured volume of beverage is still being supplied or after it has been supplied.

Figure 18 shows another glass 172 (for example a pint) of beverage 170 in this case lager, being excited (as indicated by arrow X) at the base only by an ultrasound emitter, for example by standing the glass of beverage in couplant (water) for example as shown in Figure 8. Figure 18 shows the glass 172 after it has been excited by the ultrasound for about three seconds or so, and whilst it is still being excited by ultrasound and whilst a head 174 of foam is beginning to form. As will be seen, in addition to general bubble formation at a relatively modest level throughout the volume of the

beverage 170, there is increased activity in a series of horizontal "white bands" about half-way up the height of the glass 172. Interspersed between the white hands 120 are bands 122 which are less white-coloured i.e. more beerage or lager coloured. There are typically two to four white bands 120 visible, but increased bubble formation may occur above and below the "banded region" 120, 122.

The formation of the bands 120, 122 gives the glass of beverage an attractive appearance for the few seconds that they last. It is believed that they may be associated with the formation of standing waves in the glass 172 due to the ultrasound excitation, and may represent areas of the glass which might vibrate the most (although this belief is speculative and is not to be held to be limiting). The bands 120, 122 may form generally in the central height of the glass, but they may not be right at the middle - for example, they could be one-third to two-fifths of the way down from the top (or up from the bottom).

It should also be noted that the glass 172 of Figure 18 has a mouth 124 that is narrower than a body portion 126. It is believed that having a restricted mouth forms a deeper and longer-lasting head. This may, or may not be associated with the fact that in comparison with the volume of beer associated with the fact that in comparison with the volume of beer contained a glass with a restricted mouth has a smaller exposed surface area of head than if it were in a vessel with straight sides, or outwardly flared sides.

Our trials indicate that best/better results can be achieved on pints of beverage than on half-pints of beverage. This may be associated with greater heat capacity of a pint of beverage in comparison with a half-pint of beverage, and the less effect exposure to the environment has/the less rapid

the effect of the heat transfer to the local environment, when the ratio of volume of beverage; exposed surface is larger.

Figure 19, illustrates the pint of lager of Figure 18 after about three minutes have expired (or looked at another way after about ten minutes have expired - there is little change in the appearance of the glass of lager between the three minutes and the ten minutes). The head 14 is somewhat deeper than might be expected, and slightly projects above the glass 172. There is a relatively thin layer of ice 188A (of the order of a half to a few millimetres) extending under the head completely across the diameter of the glass 172 and there is a depending projection of flaky ice 188B extending down perhaps two to five centimetres into the cleared beer. The projection 188B may extend for at least three centimetres, five centimetres is not to be taken as necessarily an upper limit to its length. The projection 188B is generally central, but may be off-axis in comparison with the central axis of the glass. It has a narrower tip than it does base (the base being the portion adjacent the head 174).

It will be appreciated that creating a beverage having such an ice formation is in itself new and itself gives a visually differentiated product - which is desirable to consumers.

Moreover, creating the bands or stripes during ultrasonic excitation of the glass of beverage also creates a visually distinct product, and a differentiated mode of provision of the product to the consumer.

With reference to Figure 20 apparatus to supply cider on draught is indicated at 202.

The draught cider is stored in a keg or cask 204. As stated above, the draught cider has a water content and a dissolved gas content.

This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the cider may be within the usual known range for ciders.

The dissolved carbon dioxide content may be substantially 1.8% by volume, and/or the dissolved nitrogen content may be substantially 18 parts per million (p.p.m).

A pump 206 is provided to pump cider from the cask 204 through a non-return valve 207 and along a pipe 208 in a chilled python known per se (not shown); the pipe comprising a heat exchange coil 210 in a remote cooling system known per se. The pipe 208 leads to a chilling coil 212 in a bath 214 of a chiller 216, from which coil a pipe 208A leads to a manual valve 218 (known per se) of a dispense outlet or nozzle 220 which may be provided at or on a drinks' bar. Bath 214 contains an ethylene glycol and water cooling mixture 222, for example 50% glycol and 50% water. The cooling mixture 222 is cooled by an evaporator 224 of a refrigeration unit 226 comprising a condenser 228, a refrigerant pump 230, and an expansion arrangement 232. A pump 234 circulates the cold mixture 222 through piping 236 forming another python 238 with the pipe 208A.

In known manner, a blanket or atmosphere of non-oxidising gas (for example carbon dioxide and/or nitrogen) from a suitable supply 240 (via a pressure regulator 242) provides a top pressure in the cask 204 and assists the pump 206 in the extraction of cider.

The top gas pressure in the cask 204 may be substantially 206.84kN/m² (30lbs/in²).

The pump 206 may develop a pressure in pipes 208, 208A of substantially 517.12kN/m² to substantially 551.58 kN/m² valve (75 to 80 lbs/in²). Normally pump 206 is not operating, thus when the valve 218 is opened the pump pressure stored in the pipes 208, 208A drops to below a pre-determined desired value which is observed by pressure switch 244 of a pump control (not shown) causing the pump 206 to operate to provide a pump output pressure of substantially 75 to 80 lbs/in². The chiller 216 is arranged to cool the cider passing through to the outlet nozzle 220 to a pre-determined temperature in the range of substantially -1°C to substantially -12°C, for example -6°C. The cider reaches the nozzle 220 at that pre-determined temperature and issues therefrom into an open-topped vessel 46 (Figure 2) which may be a drinking vessel, for example a drinking glass. In Figure 20 the cider issuing from the outlet opening of the outlet nozzle 220 passes through a sparkler 247 (known per se). Instead of or in addition to said sparkler 247, a known orifice plate may be mounted in nozzle 220. But if desired, neither an orifice plate nor a sparkler may be fitted.

When valve 218 is closed, the pressure switch 244 observes a build-up in pressure in the pipes 208, 208A above a predetermined value and the control switches off the pump 206.

With reference to Fig 21, the draught cider 248 is delivered from the outlet 220 (Figure 20) into the drinking vessel 246, for example a glass which is preferably rather tall and preferably has a clear or transparent wall. Preferably the vessel 246 is chilled before it receives the cider. The vessel

246 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 250 when the vessel contains a full measured volume, for example a pint, of the cider.

Immediately the cold cider 250 is poured into the chilled vessel 246, the vessel is placed in a shallow depth of water 252 in a dish part 254 of an ultra-sound generating apparatus 256 in which the dish 254 is securely mounted or affixed against a base part 258 containing an ultra-sound emitter 260. The emitter 260 may be arranged to emit ultra-sound signals in a frequency range of substantially 20kHz to 70kHz. For example the cider may be subject to ultra-sound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 252 providing an ultra-sonic transmission path or coupling. The cider 250 may be subject to the ultra-sound for any desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about five seconds.

The result in a short time is shown in Figure 22 in which the exposure to ultra-sonic signals has promoted sudden formation of bubbles of dissolved gas throughout the liquid cider 248 some bubbles 252A may be relatively large whilst others 252B may be relatively small and may tend to collect linearly in wavy lines which may snake upwardly. Also the head 250 may rise to increase its height or depth. The gas bubbles form nucleation sites encouraging the quick formation of ice in the cider 25 0 from water of the water content of the cider. The ice rises. It may be of a slushy character and tends to agglomerate in the lower part of and below the head 250 to form a slushy mass of ice 262 such as indicated in Figure 23 in the cider.

Going from the stage shown in Figure 21 to that in Figure 23 may only take one or two minutes so that the gas bubbling and the formation and visible development of the ice takes place fairly quickly and be interesting phenomena to observe through the glass 246.

Besides the ice forming in the cider 248 being an intriguing sight, it helps show the customer the cider is cold and that it has not been diluted by addition of ice from water other than that already in the cider.

One of the most interesting features is that the head 250 on the glass of cider may last for a considerable time, i.e. several times the duration of a head on cider arising from known methods. The head 250 may last for twenty minutes or so. Its longevity may be due to (i) the mass of ice 262 acting as a seal or barrier to gas attempting to leave the liquid cider body, and/or (ii) the fact that the ice 262 is keeping the head 250 cold.

An alternative method of applying the ultra-sound signals is represented in Figure 24, in which after the apparatus 202 in Figure 20 has dispensed a vessel or glass 246 of cider 248 an ultra-sound probe 264 powered through cable 266 is dipped into the cider for emitter 260A to give out ultra-sound signals. The probe 264 may be inserted into the cider before the full measured amount is supplied to the vessel 246.

In Figure 25, the dispense outlet 220 has been arranged to act as an ultra-sonic probe for example by providing it with an ultra-sonic emitter 260B. The ultra-sonic probe 220 in Figure 25 may emit ultra-sound signals whilst cider is padding through it to the vessel 246, and/or may become partially immersed in the cider as shown and emit ultra-sound signals into

the cider 248 in the vessel 246 whilst the measured volume of cider is still being supplied or after it has been supplied.

CLAIMS

1. A beverage in an open topped vessel, said beverage comprising a water content and a dissolved gas content, and in said vessel the beverage has a head of foam over ice, said ice being formed in the beverage from water of said water content.

2. A method of keeping a beverage in an open-topped vessel cool said beverage comprising a water content and a dissolved gas content, and said method comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

3. A method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on the beverage such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

4. A method of sustaining a head on a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content said method comprising providing said head on the beverage and forming ice in the beerage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

5. An open-topped vessel of a beverage, the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

6. A beverage as claimed in claim 1 or claim 5 or a method as claimed in any one of claims 2 to 4 in which the beverage has been subjected to the effect of ultrasound signals and the beverage is draught beverage delivered into a vessel.

7. A beverage as claimed in claim 5 or claim 6 or a method as claimed in Claim 6, in which immediately before the draught beverage is delivered into the vessel said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

8. A method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beer to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beer into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas bubble nucleation means.

9. A beverage as claimed in any one of claims 5 to 7, or a method as claimed in claim 8, in which the ultrasound signals are applied externally of said vessel.

10. A beverage as claimed in any one of claims 5 to 9, or a method as claimed in claim 8 or 9, in which the ultrasound signals are applied internally of said vessel to the cooled beverage.

11. A beverage as claimed in claim 10 or a method as claimed in claim 10, in which an ultrasound signal emitter is disposed in the beverage in the vessel emitting ultrasound signals into the beverage in the vessel.

12. A beverage as claimed in any one of claims 9, 10, or 11 or a method as claimed in any one of claims 9, 10, or 11, in which a dispense outlet or nozzle from which beverage is delivered into said vessel is adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals.

13. A beverage as claimed in claim 12 or a method as claimed in claim 12, in which aforesaid ultrasound signals are applied to aforesaid beverage flowing through the dispense outlet.

14. A beverage as claimed in any one of claims 5 to 13, or a method as claimed in any one of claims 6 to 13 in which the ultrasound signals have a frequency in the range of 20kHz to 70kHz.

15. A beverage or a method as claimed in claim 14, in which the ultrasound signals have a frequency of substantially 30kHz.

16. A beverage as claimed in any one of claims 1, 5, 6, 7, 9, to 15, or a method as claimed in any one of claims 2 to 4 or 8 to 14, in which a mass of said ice develops downwards in the beverage below the head.

17. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 16, or a method as claimed in any one of claims 2 to 4 or 8 to 16 in which the vessel is chilled before beverage is delivered thereinto.

18. A beverage or a method as claimed in claim 17, in which the vessel is chilled to a temperature of substantially 4°C, or the vessel is chilled to a temperature less than 4°C.

19. A beverage or a method as claimed in claim 17, in which the vessel is chilled to a temperature of substantially 0°C.

20. A beverage as claimed in claim 7 or in any one of claims 9 to 19 when appended to claim 7, or a method as claimed in claim 8 or in any one of claims 9 to 19 when appended to claim 8, in which the beverage is cooled to a temperature between substantially -1°C and substantially -12°C.

21. A beverage or a method as claimed in claim 20, in which the beverage is cooled to a temperature between substantially -4°C and substantially -6°C.

22. A beverage as claimed in any one of claims 1, 5, 6, 7, or 9 to 21 or a method as claimed in any one of claims 2 to 4 or 8 to 21 , in which the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

23. A beverage or a method as claimed in claim 22, in which the vessel is a glass drinking vessel.

24. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 23, or a method as claimed in any one of Claims 2 to 4 or 8 to 23 in which the beverage has a pale beer colour.

25. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 24 or a method as claimed in any one of claims 2 to 4 or 8 to 24 in which aforesaid dissolved gas comprises carbon dioxide and/or comprises nitrogen.

26. A beverage or a method as claimed in claim 25, in which the dissolved nitrogen content in the beverage is in the range of substantially zero parts per million (p.p.m.) to substantially 100 parts p.p.m.

27. A beverage or a method as claimed in claim 25 or in claim 26, in which the dissolved carbon dioxide content is about zero % by volume or greater.

28. A beverage or a method as claimed in claim 27, in which the carbon dioxide is substantially 2.2% or substantially 4% or substantially 5% by volume.

29. A beverage as claimed in any one of claims 5 to 7 or in any one of claims 9 to 28 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 28 when appended to claim 8, in which the ultrasound signals are accompanied by a mechanically or electrically produced audible performance and/or a visible light display.

30. A beverage or a method as claimed in claim 29, in which the audible performance is a tuneful or musical sound.

31. A beverage or a method as claimed in claim 29 or claim 30, in which

the visible light display comprises visible flashes of light.

32. A beverage as claimed in claim 6 or claim 7, or in any one of claims 9 to 32 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 31 when appended to claim 8, in which the beverage is subjected to ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

33 A beverage comprising a water content and a dissolved gas content wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a container to be drunk exposed to ambient atmospheric pressure, and wherein in said container aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

34. A beverage to be available on draught and comprising a water content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a container open to ambient atmospheric pressure so that the aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

35. A beverage as claimed in Claim 33 and in any one of Claims 5 to 7 or 9 to 32, or as claimed in Claim 34 and in any one of Claims 5 to 7 or 9 to 32, wherein said container is said open-topped vessel.

36. A beverage as claimed in claim 35 in which said vessel has at least a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

37. A beverage as claimed in claim 35 or claim 36 in which the vessel is made of glass.

38. A beverage as claimed in any one of claims 35 to 37, in which the vessel has a shape or formation to promote formation of said ice.

39. A beverage as claimed in any one of claims 35 to 38, in which the vessel has an internal surface arranged to provide nucleation sites to promote formation of said ice.

40. A beverage as claimed in claim 39, in which said surface has at least a surface portion which is roughened.

41. A beverage as claimed in any one of claims 35 to 40, in which the vessel has at least a wall portion arranged to change colour automatically with variations in temperature.

42. A beverage as claimed in claim 41, in which said wall portion comprises thermo-chromic material.

43. A beverage as claimed in any one claims 33 to 42 in which the formed ice includes therein one or more streaks or regions of one or more colours which contrasts(s) with the colour of the ice and/or beverage.

44. A method of serving a draught beverage which comprises a water content and a dissolved gas content, said method comprising issuing the draught beverage from an outlet into an open topped vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric

pressure, and in said vessel aforesaid gas bubbles out of the beverage at least a portion of said water becomes ice.

45. A method of providing a visual display or effect within an open-topped vessel having at least a portion of wall of some transparency, said method comprising providing a draught beverage comprising a water content and a dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling of the beverage which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, a visual display or effect developing in the beverage in the vessel,. said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becoming ice.

46. A method as claimed in claim 44, in which the vessel has a wall portion of some transparency.

47. A method as claimed in any one of claims 44 to 46, in which the vessel comprises glass.

48. A method as claimed in any one of claims 44 to 47, in which formation of ice develops in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

49. A method as claimed in any one of claims 44 to 48, in which the vessel has at least a wall portion which changes colour automatically with variation in temperature.

50. A method as claimed in claim 49, in which said wall portion comprises thermo-chromic material.

51. A method as claimed in any one of claims 44 to 49 in which the vessel has a shape or formation to encourage the forming of the ice.

52. A method as claimed in any one of claims 44 to 51, in which the vessel has one or more internal formations to encourage the forming of the ice.

53. A method as claimed in claim 52, in which at least a portion of an internal wall of the vessel has a roughened texture.

54. A method as claimed in any one of claims 44 to 53, in which the vessel is adapted to encourage formation of further ice in the beverage below an upper layer of forming ice, and said further ice rising to joint said upper layer.

55. A method as claimed in any one of claims 44 to 54, in which an implement is inserted into the beverage in the vessel to encourage formation of said ice.

56. A method as claimed in claim 55, in which said implement is a thermometer.

57. A method as claimed in claim 56, in which said implement is a swizzle-stick.

58. A method as claimed in any one of claims 44 to 57, in which colouring material or dye is provided to form at least one coloured streak or

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66. Apparatus as claimed in any one of claims 61 to 65, comprising a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

67. Apparatus as claimed in any one of claims 61 to 66 in which a beverage flow path connects a reservoir of said draught beverage to said heat exchange means.

68. Apparatus as claimed in claim 67, in which said flow path comprises at least a portion of said loop.

69. Apparatus as claimed in claim 67, in which said flow path divides into a plurality of beverage routes, and said loop comprises one or more of said routes.

70. Apparatus as claimed in claim 67, in which intermediate said reservoir and said first-mentioned beverage cooling heat exchange means, the beverage is subject to the effect of second beverage cooling heat exchange means.

71. Apparatus as claimed in claim 67 in which the reservoir is subjected to cooling.

72. Apparatus as claimed in any one of claims 61 to 67, in which said heat exchange means is first heat exchange means and second beverage cooling heat exchange means is provided to act on at least a portion of said loop.

73. Apparatus as claimed in claim 72, in which coolant common to the first and second heat exchange means circulates therethrough.

74. Apparatus as claimed in claim 67, in which intermediate said reservoir and said loop the beverage is subject to the effect of further beverage cooling heat exchange means.

75. Apparatus as claimed in any one of claims 61 to 74 in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature below the freezing point of water at the ambient atmospheric pressure.

76. Apparatus as claimed in any one of claims 61 to 74, in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature of between substantially -1°C and substantially -12°C.

77. A beverage as claimed in any one of Claims 1, 5 to 7, 9 to 43 or 60, or a method as claimed in any one of Claims 2 to 4, 8, 9 to 32 or 44 to 60, or an apparatus to supply a beverage as claimed in any one of Claims 61 to 76, in which the beverage is non-alcoholic.

78. A beverage as claimed in any one of Claims 1, 5 to 7, 9 to 43 or 60, or a method as claimed in any one of Claim 2 to 4, 8, 9 to 32 or 44 to 60 or an apparatus to supply a beverage as claimed in any one of Claims 61 to 76 in which the beverage is an alcoholic beverage.

79. A beverage, a method or an apparatus as claimed in Claim 78 in which said alcoholic beverage is a beer.

80. A beverage, a method or an apparatus as claimed in Claim 76 or Claim 77, in which said beer is a lager.

81. A beverage, a method or an apparatus as claimed in Claim 76, in which said alcoholic beverage is a cider.

82. A method of serving draught cider in an open-topped vessel and wherein said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

83. A method as claimed in Claim 82, in which the cider is cooled to a temperature in the range of substantially -1°C to substantially -12°C.

84. A method as claimed in Claim 83, in which the cider is cooled to a temperature of substantially -6°C.

85. A method as claimed in any one of Claims 82 to 84, in which the cooled cider issues from a dispense outlet through a sparkler.

86. A method as claimed in any one of Claims 82 to 84, in which the cooled cider passes through an orifice plate in a dispense outlet from which the cider issues.

87. A method as claimed in any one of Claims 82 to 86, in which the open-topped vessel is chilled before receiving the cider.

88. A method as claimed in Claim 87, in which the open-topped vessel is chilled to substantially 4°C or chilled to a temperature lower than 4°C.

89. A method as claimed in Claim 88, in which the open-topped vessel is chilled to substantially 0°C.

90. A method as claimed in any one of Claims 82 to 89, in which said ultra-sound signals have a frequency in the range of substantially 20kHz to substantially 70 kHz.

91. A method as claimed in Claim 90, in which the ultra-sound signals have a frequency of substantially 30kHz.

92. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied externally of said vessel to said vessel.

93. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied internally of said vessel to the cooled cider.

94. A method as claimed in Claim 93 in which an ultra-sonic signals emitter is disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

95. A method as claimed in Claim 93 or 94, in which a or the dispense outlet from which the cooled cider issues into said vessel is adapted to act as an ultra-sonic signal emitter to produce aforesaid ultra-sound signals.

96. A method as claimed in Claim 95, in which aforesaid ultra-sound signals are applied to aforesaid cider flowing through the dispense outlet.

97. A method as claimed in any one of Claims 82 to 96, in which the dissolved gas content comprises carbon dioxide and/or nitrogen.

98. A method as claimed in Claim 97, in which the carbon dioxide content is substantially zero % by volume or greater and/or the nitrogen content is substantially zero parts per million (p.p.m.) or greater.

99. Cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, and wherein said cider has a head of foam over ice, said ice being formed in the cider from water of said water content.

100. Cider as claimed in Claim 99, in which said head and ice are produced at least in part by performance of a method as claimed in any one of claims 82 to 98.

101. A method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head.

102. A method as claimed in Claim 101, in which said head and ice are produced at least in part by performance of a method as claimed in any one of Claims 82 to 98.

103. A beverage as claimed in Claim 1 and substantially as hereinbefore described with reference to Figures 1 to 19 or Figures 20 to 25 of the accompanying drawings.

104. A method of keeping a beverage in an open-topped vessel cool, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7,

or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24 or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 of the accompanying drawings.

105 A method of sustaining cooling ice in a beverage in an open-topped vessel and wherein said ice is formed in the beverage from water of a water content of the beverage, said method being substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

106. A method of sustaining a head on a beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

107. A method of serving draught beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or

Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25.

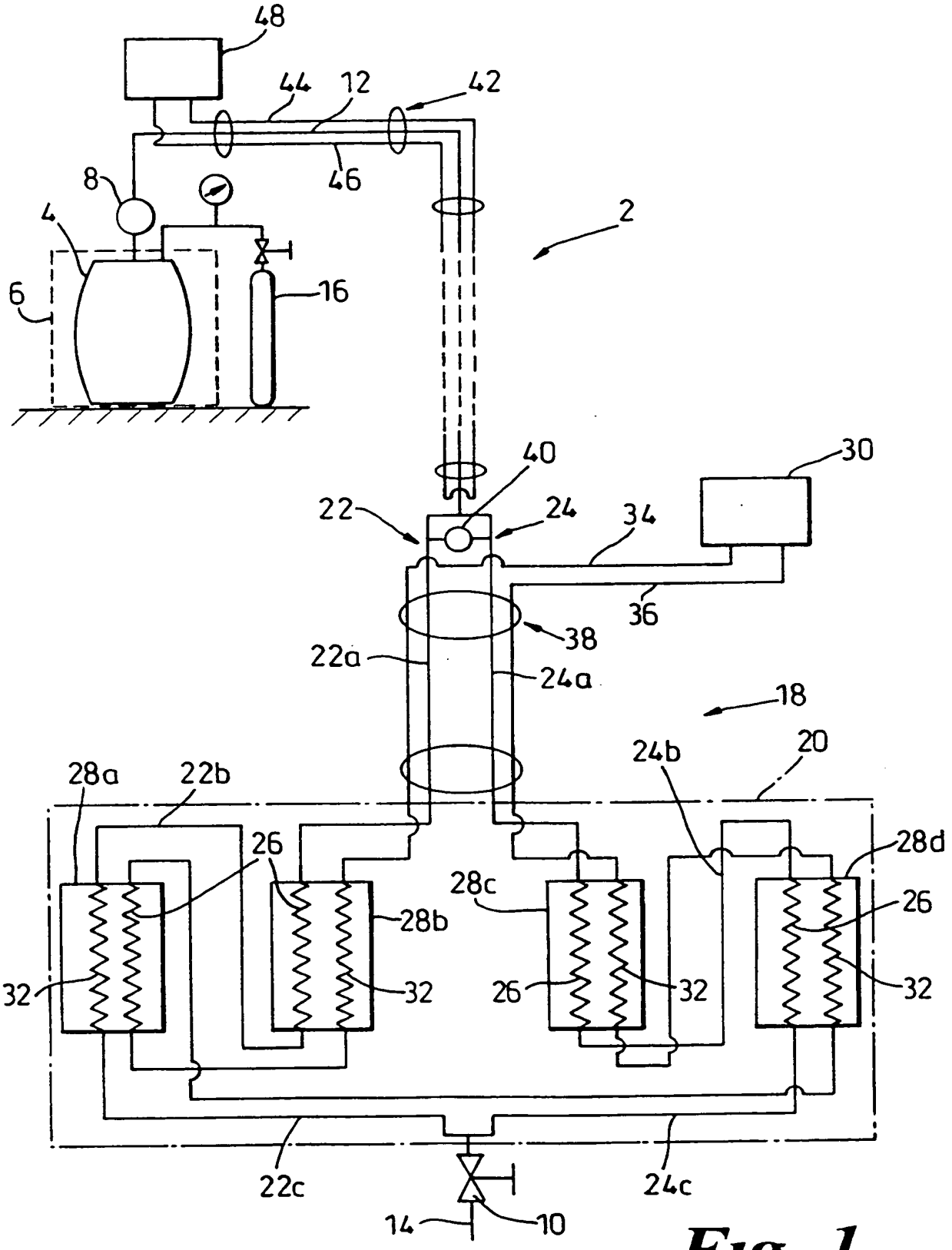
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Fig 1

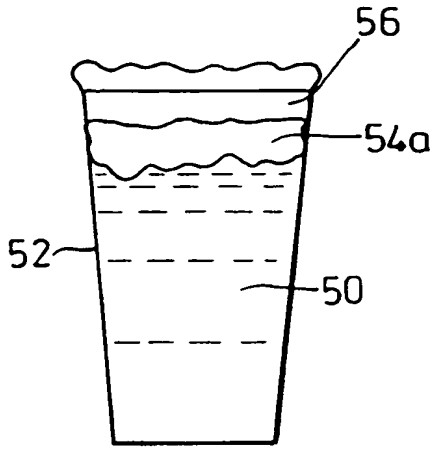

Fig. 2

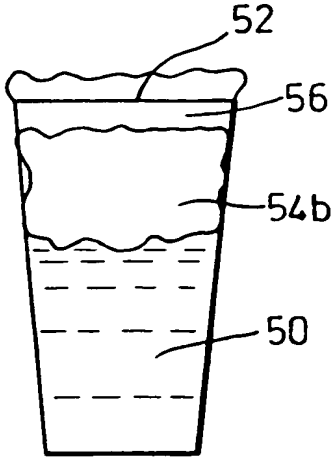

Fig. 3

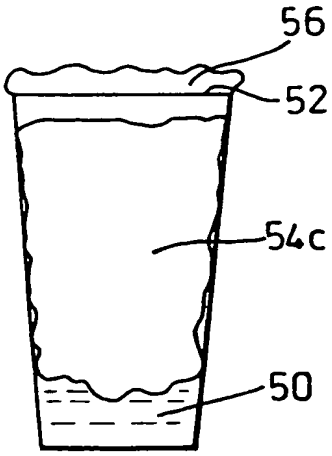

Fig. 4

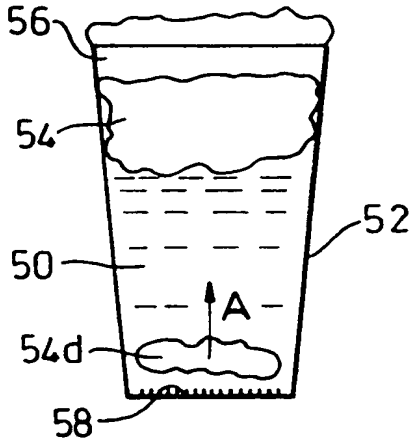

Fig. 5

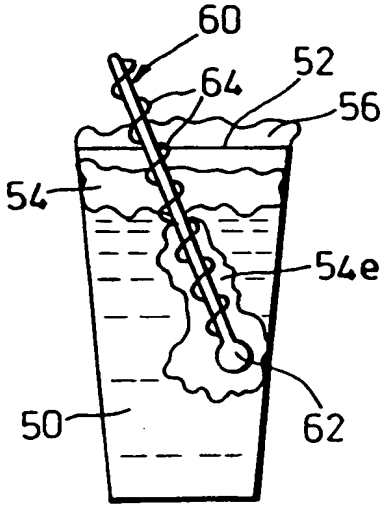

Fig 6

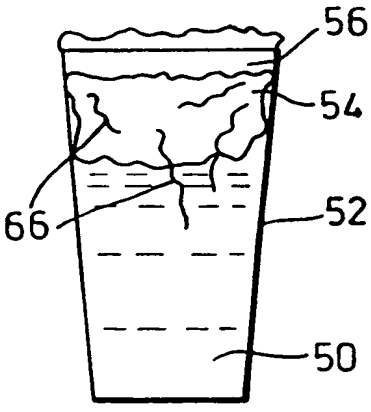

Fig. 7

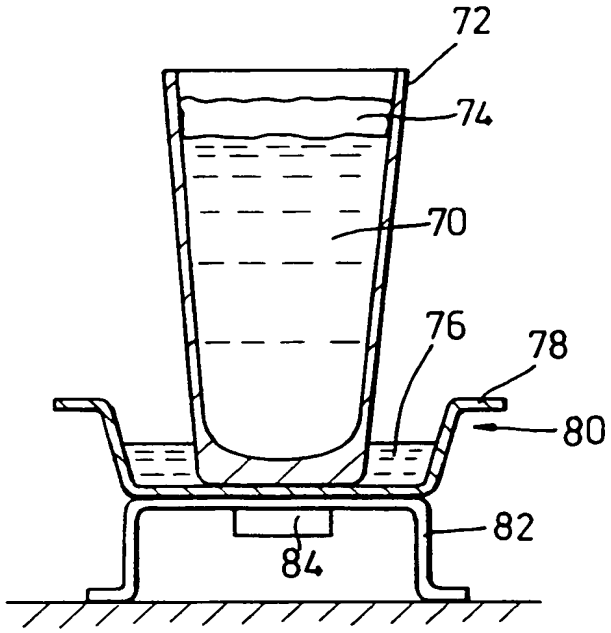

Fig. 8

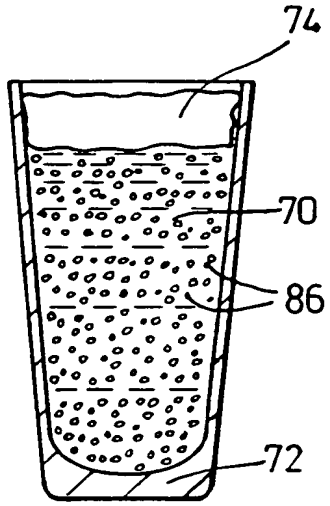

Fig. 9

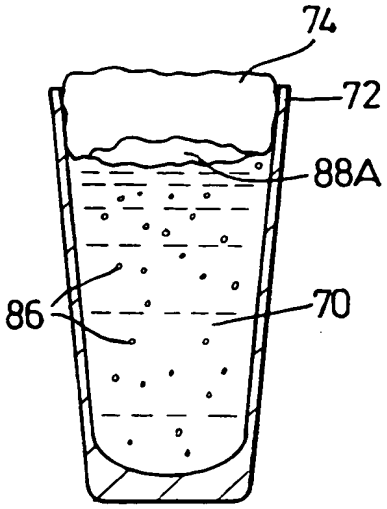

Fig. 10

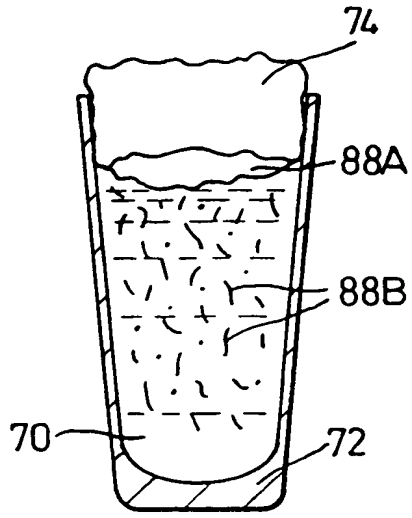

Fig 11

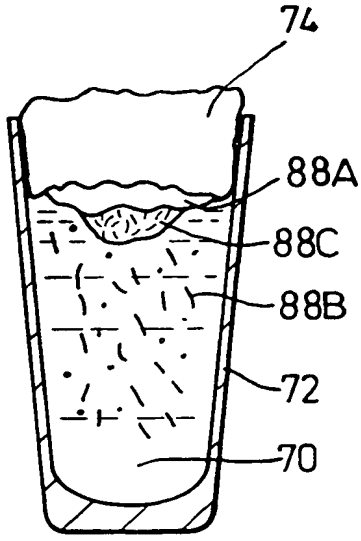

Fig 12

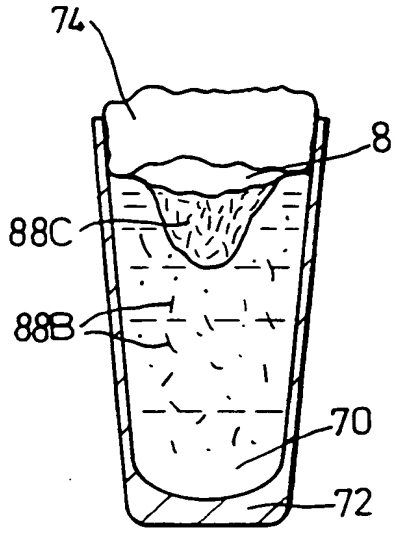

Fig. 13

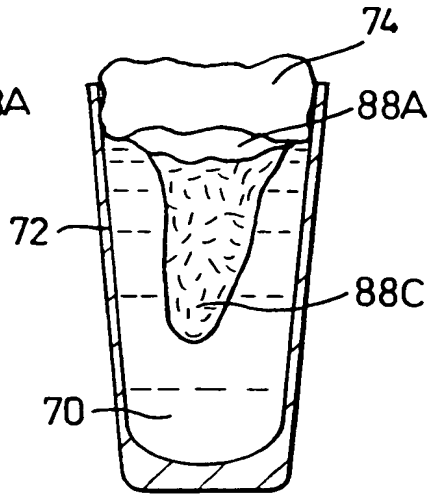

Fig. 14

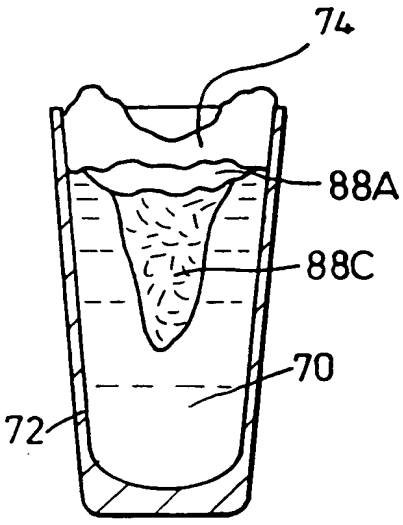

Fig. 15

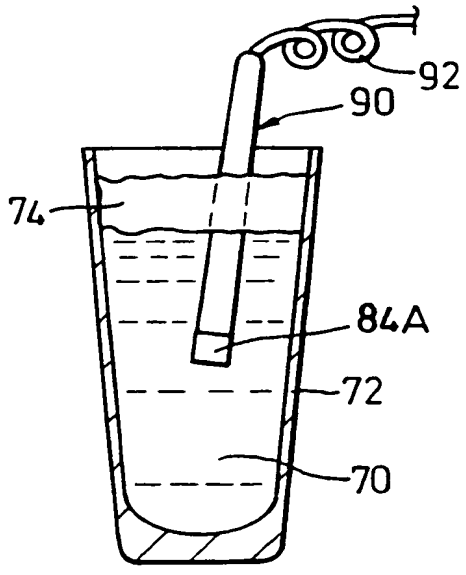

Fig. 16

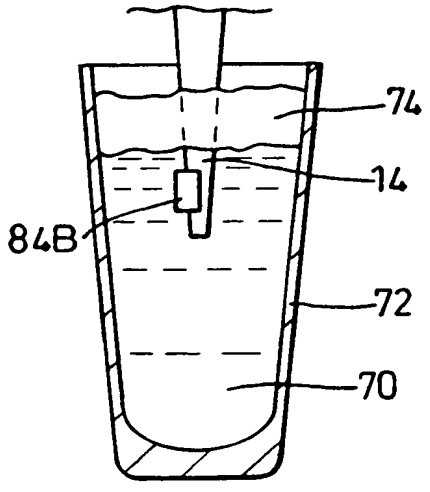

Fig 17

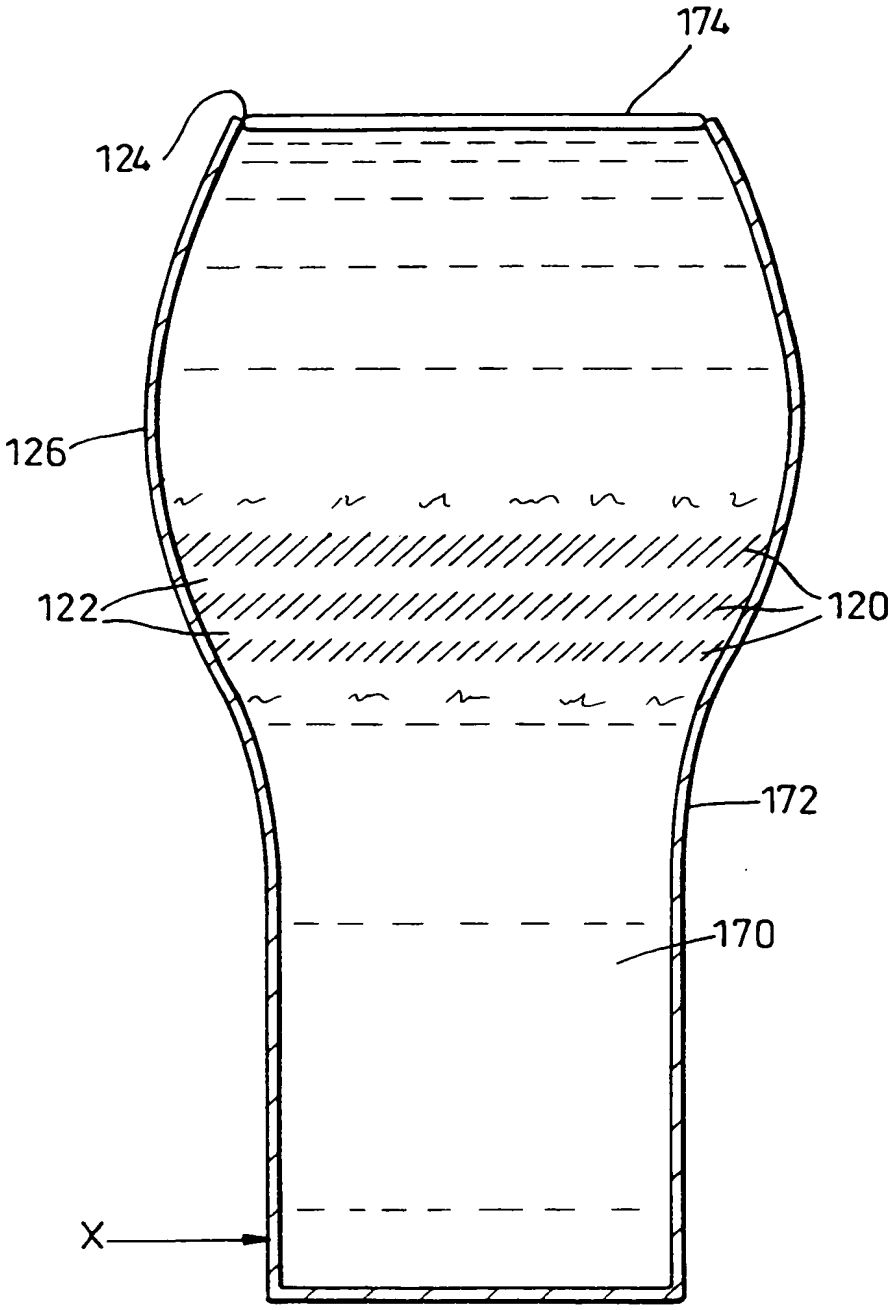

Fig. 18

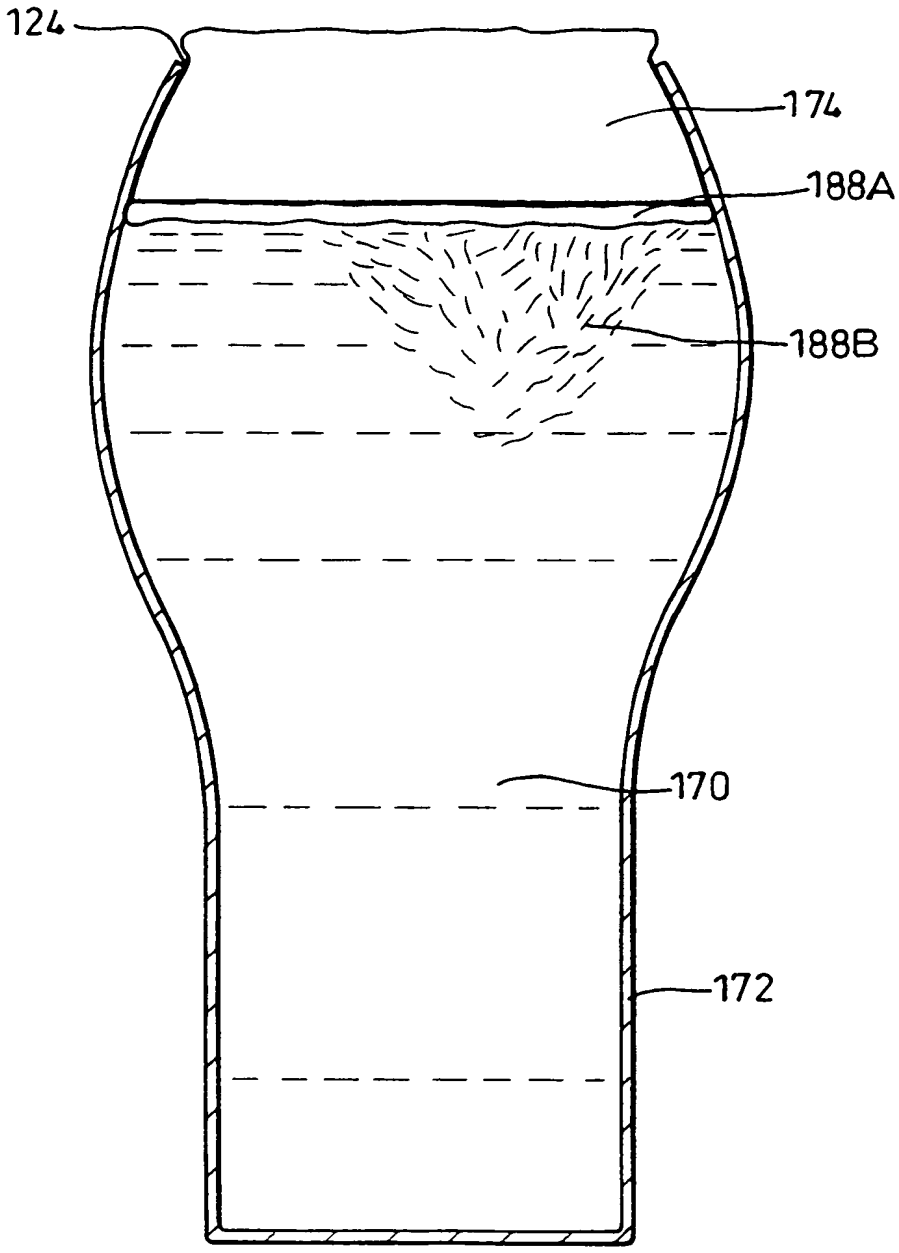

Fig. 19

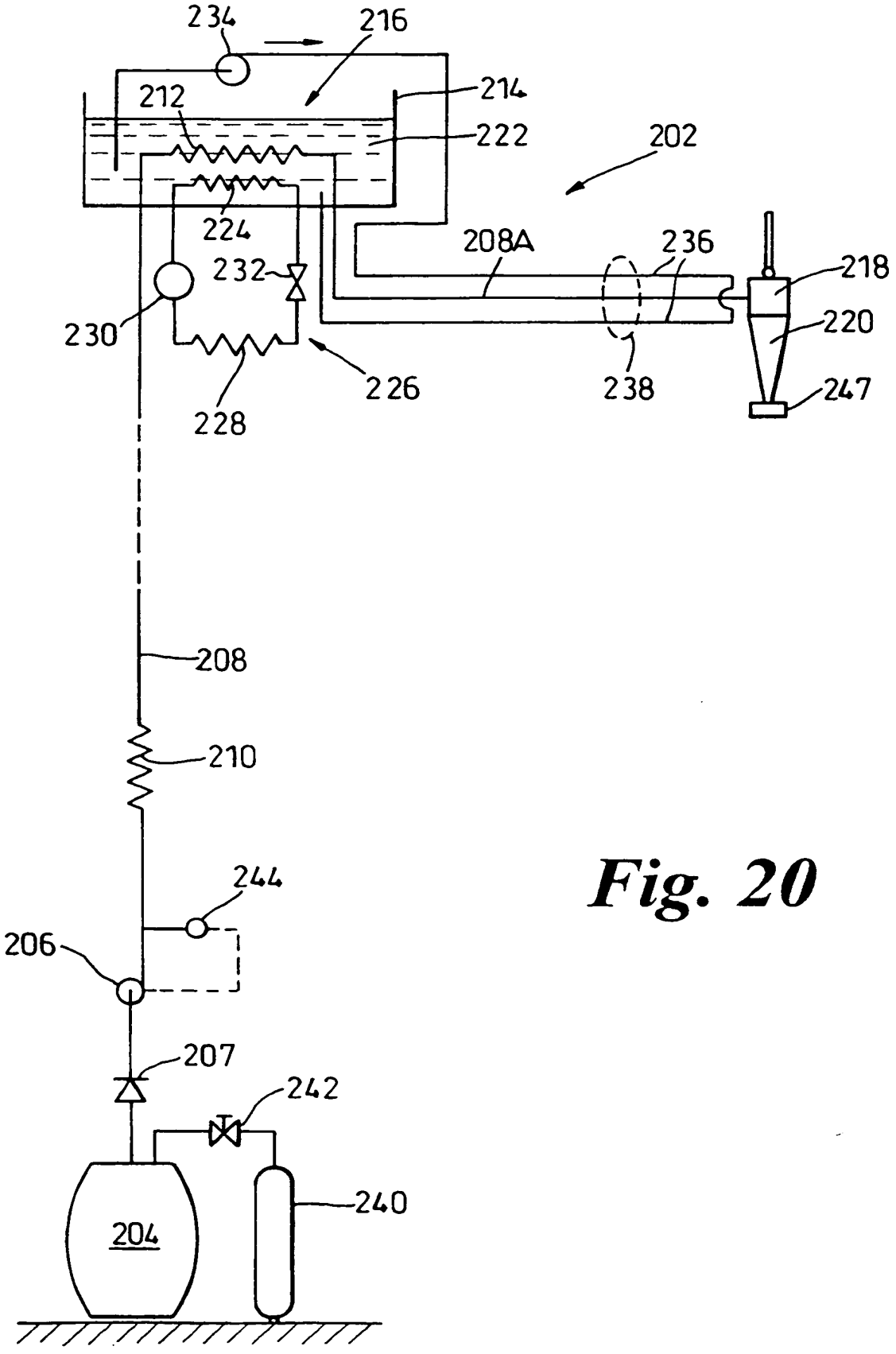
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Fig. 20

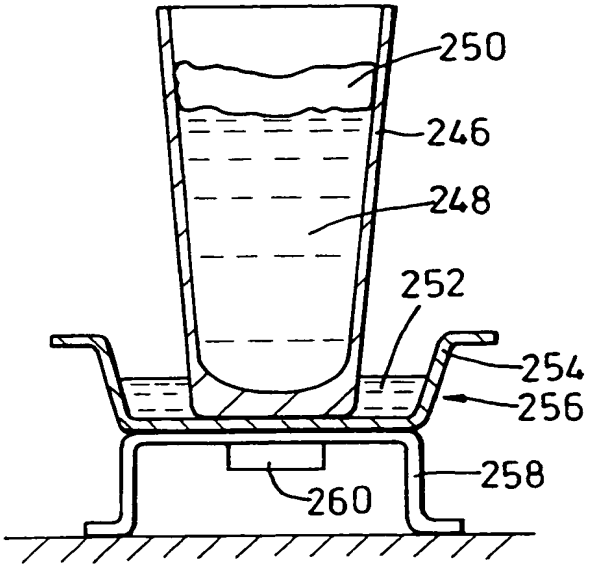

Fig. 21

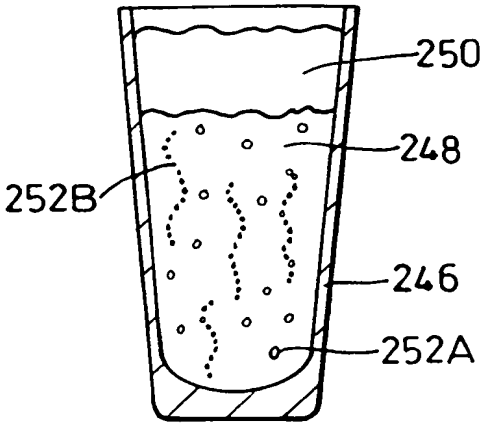

Fig. 22

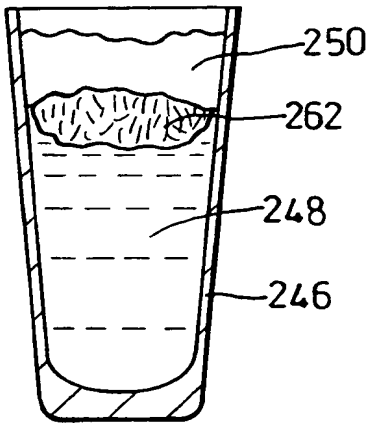

Fig. 23

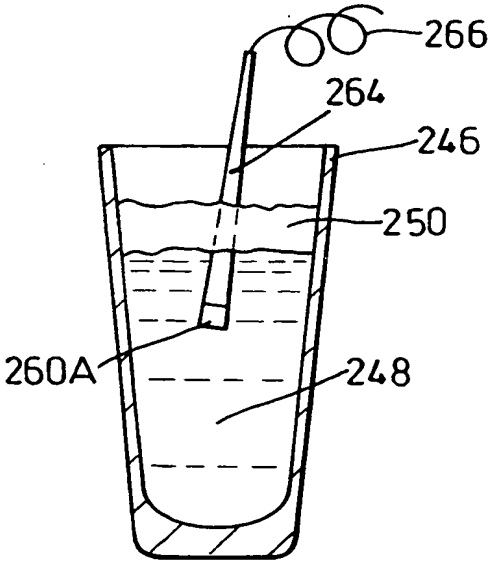

Fig. 24

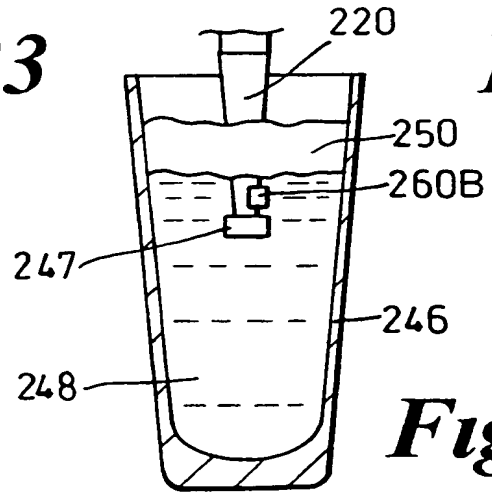

Fig 25

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/01551

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C12H1/18 B67D1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C12H B67D C12G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 826 829 A (MARULICH A) 30 July 1974 (1974-07-30) column 2, line 16 - line 32 column 4, line 1 - line 8 column 4, line 57 - line 62 ---	2,33
X	DATABASE WPI Section Ch, Derwent Publications Ltd., London, GB; Class D13, AN 1971-19784S XP002119502 & JP 46 010033 B (MORINAGA MILK INDS CO LTD) abstract --- -/--	2,33

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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Date of the actual completion of the international search	Date of mailing of the international search report
20 October 1999	29/10/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Charles, D

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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